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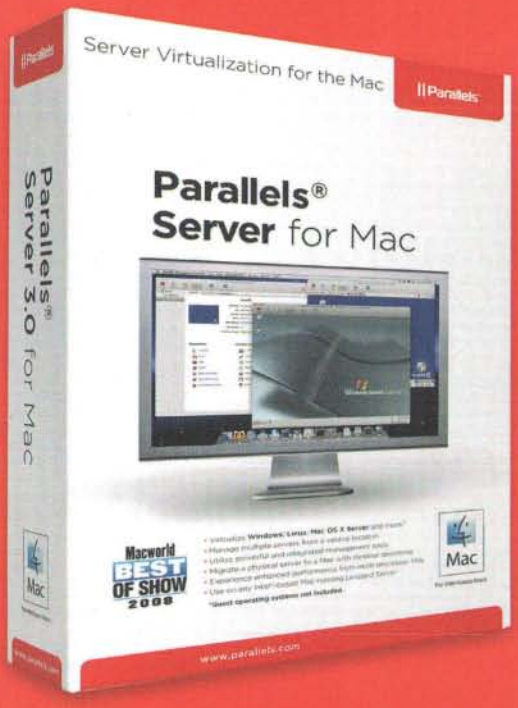

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From the Editor

We're drawing 2009 to a close and opening 2010. The "00's" are over! What an interesting decade it has been far Apple. Watching OS X go from birth to...well, "maturity" may be a bit of a stretch. 'Responsible young adult' could fit, though. It's certainly still changing and malleable.

Another interesting thing is Apple's history and timeline. We're running the first of our "25th Anniversary Stories" this month, featuring Dave Mark. There's enough history at this point that not everyone involved in the Mac landscape now remembers what it was like then. That fascinates me a bit. Some people have been drawn in from other platforms and some have started with the Mac and have known little else. Some are not very computer-savvy but bought a Mac thanks to the iPhone. Whatever the reason, there's a diverse mix of developers and end-users, and that can be even more demanding for developers and support staff. This base is more knowledgeable about technology in general and has seen what most platforms have to offer. They want the best parts of everything they see. 25 years ago, though? Check out Dave Mark's musings.

Before we do close out the decade, though, this issue has plenty of up-to-date information for you. The cover story by new author David Garcea is a tour-de-force on tracking down crashes from crash logs. Awesome reading for everyone.

This month's Mac in the Shell presents a little more about Vim. It's one thing to learn the basic commands, but to really start to tailor vim for your environment and liking is to just bring the experience to a new level.

Greg Neagle, writing for MacEnterprise details the changes to packages and receipts in Snow Leopard. There's a lot of detail here – anyone that packages up software for distribution should be paying attention to this.

William Smith is back with a non-Microsoft Microsoft article. Exchange has become popular enough that several alternatives present themselves as an Exchange server just to interact with the many clients that take advantage of Exchange protocols. William takes you through these non-Exchange servers and how they stack up.

Dave Dribin continues his Road to Code column and introduces concurrency. What good is multi-processing if you can't take full advantage of it? Dave gets you into the basics

Speaking of Vim, I was thrilled to have Björn Winckler in our MacTech Spotlight. Björn is the maintainer of MacVim – an OS X-specific build of Vim that takes advantage of OS X features, integrating it into the Mac GUI smoothly.

Rounding out the issue is our 2010 Buyer's Guide – companies you can look to for products and services in the '10's.

Enjoy the holiday season and the New Year, and I hope to see everyone at Macworld in February!

Ed Marczak,
Executive Editor

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by Edward Marczak

Tweaking Vim

Or, How I learned to love the shell

Welcome

Well, OK, I already *do* love life in a command shell. I've gotten a lot of good feedback on the Python tutorials in the column, but I've also heard from people looking to get back to bash and shell tips. I figure I can combine those two a little. I've already written about the basics of vi – the console-based text editor. But that's not going to make anyone *love* it. To *love* it, you need to control it. Command it. *Personalize* it. No matter if you're whipping up a shell script, editing a text document or writing a long Python program, a customized vim will go a long way toward making your job easier and more pleasurable.

Refrain

I won't go too deeply into the basic operation of Vim, as I've already done that in a past column (available on-line at http://www.mactech.com/articles/mactech/Vol.22/22.12/2212macintheshell/index.html). I'll mention a few quick reminders, first, though.

On OS X, and most modern Unix machines, vi is just a link to vim, so they're relatively interchangeable. You can still run vim in vi compatibility mode, however, there's rarely reason to do so.

Vim is a modal editor, meaning that your interactions with it depend on a particular mode. The six basic modes are:

Normal mode: In normal mode, you enter editor commands. This is the mode Vim defaults to at start. This is also known as "command mode."

Visual mode: This is like normal mode, however, the movement commands highlight a selection of text. When a command is given, it is executed for the highlighted area.

Select mode: Typing a printable character deletes the selection and starts insert mode.

Insert mode: The most often used mode, the text you type is inserted into the buffer.

Command-line mode: Typing a ":" in normal mode puts the editor into command-line mode where you can execute Ex commands.

Ex mode: After entering a command in command-line mode, you remain in Ex mode.

Turning up the throttle on vim editing will require you to recognize these modes and how to enter and exit them. If you ever do not know which mode you are in, press escape twice: this will put the editor in normal mode.

Don't be Afraid

There are plenty of actions in Vim that even people who have been using it for a while don't always take in. Let's start at the beginning. Open a terminal window and type `vim`, with no arguments. This brings you to an opening splash screen, ready for action. Figure 1 shows this screen.

```
                VIM - Vi IMproved

                 version 7.2.108
             by Bram Moolenaar et al.
   Vim is open source and freely distributable

          Become a registered Vim user!
type  :help register<Enter>   for information

type  :q<Enter>               to exit
type  :help<Enter>  or  <F1>  for on-line help
type  :help version7<Enter>   for version info
```

Figure 1-Vim at startup.

As mentioned, Vim starts in normal mode. To give Vim a command, type a colon (":") and the command, followed by a carriage return (read: press return). To edit a file, you can specify it with the edit command:

```
:e some_file.txt
```

This presumes you know the name of the file. Or does it? Vim supports wildcard completion using the wildchar – Tab by default. The :e command followed by Space-Tab will cycle though the directories and files in the current working directory. You can go one better, though.

One Vim function I rarely see used is the file browser. It's built right into Vim. Rather than supply the edit command with a file, give it a directory:

```
:e .
```

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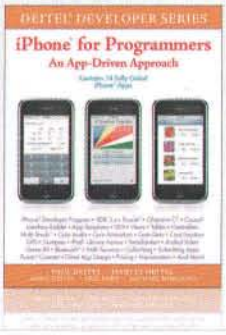

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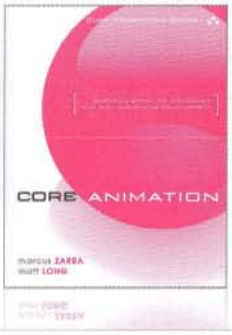

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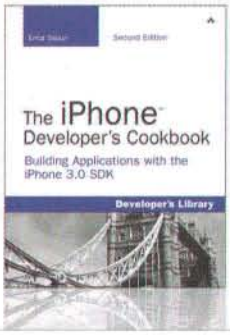

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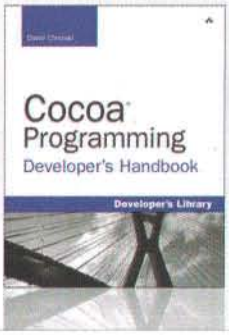

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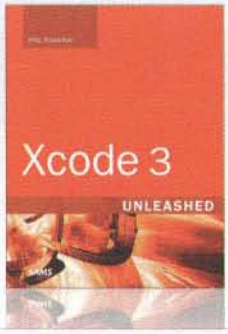

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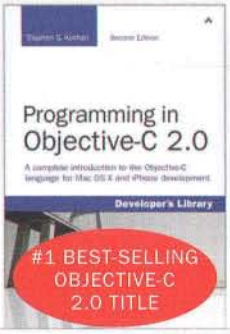

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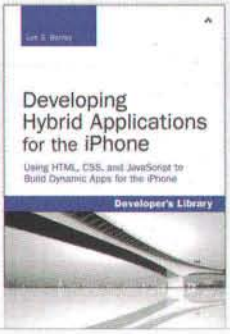

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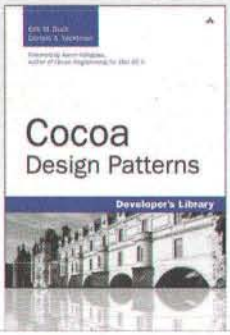

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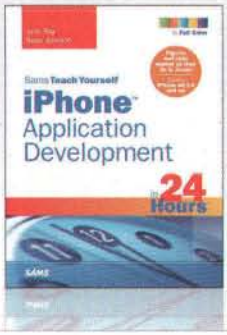

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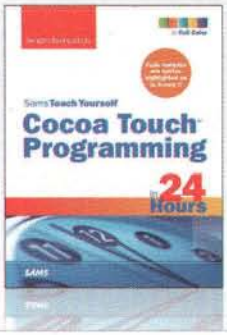

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...and that directory will be displayed interactively. Figure 2 shows Vim's file browser.

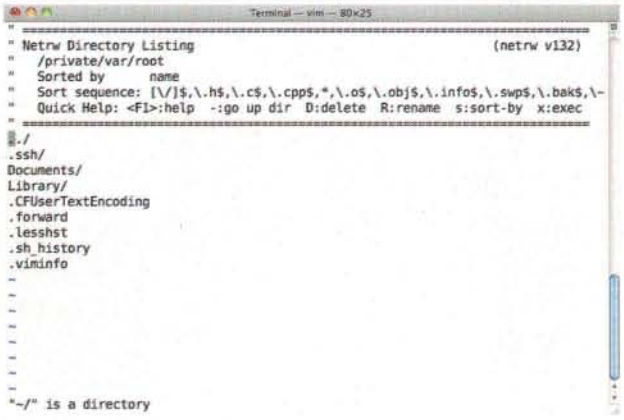

Figure 2-Vim's file browser

As you can see, there's not only a listing of the files in this particular directory, but interactive commands listed along the top portion of the buffer. Pressing 's' will change the sort order between name, time and size. Pressing return will enter the directory under the cursor. Pressing '-' will go to the parent directory. Ultimately, when you find a file you want to edit, just press return while the cursor is over that filename and it will be loaded into the buffer. Go find a file to edit – either your own, download something, or copy and open a lengthy file from /etc. If you're at a total loss, the test file I'm using is up on the Mac Tech ftp site (ftp://ftp.mactech.com/src/mactech/volume25_2009).

Of course, the vast majority of the time, you'll pass in the name of the file you're initially editing as an argument to Vim. However, there are many times that once you're editing one file, it's nice to know how to open a new file without leaving Vim.

Make it Better

Those tips are fine on their own, but now, you're faced with repeating this in the future, and ultimately editing the file. Vim runs fairly bare-bones out of the box, but there are many settings that can be adjusted. This is done via the :set command. Just to get the hang of it, here are two basic ones that I can't do without in a text editor:

```
:set ruler
:set number
```

Turning on the ruler presents a guide in the lower right corner of the Vim window that displays the co-ordinates of the cursor, and a percentage of how deep into the file the buffer is displaying (or "Top" or "Bottom" as appropriate).

Turning on line numbers I personally consider critical. Perhaps not for word processing-like tasks, but certainly for any kind of coding.

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Of course, we can do better. First, editors are personal. We like to tweak them until they're *just* right. I have too many customizations to handle, and there's no way I'm going to type in :set this and :set that each time I run Vim. So let's get this out of the way right now. In your home directory, create a file—using Vim, of course—named .vimrc. This is Vim's default startup file that it will process each time it is invoked. If you like seeing the ruler and line numbers all the time, add:

```
set ruler
set number
```

to the .vimrc at the root of your home directory. Note that there are no leading colon characters—.vimrc is read and commands are executed just as if they were typed in ex mode.

One alteration I should mention early: we're using Vim—vi *improved*—so let's actually take advantage of that. We should always set `nocompatible` to ditch the vi compatibility mode: there's very little reason anyone needs this nowadays. (What are you waiting for? Go type ":set nocompatible" now!).

I happen to use Vim for just about everything text editing-related. This includes word processing. Vim easily rivals Word or Open Office…if it's configured correctly (and, of course, if you're not trying to use a word processor as a page layout application). Many people don't realize that Vim can even real-time spell-check documents. Here are the options I use in ~/.vimrc for word processing:

```
set formatoptions=1
set lbr
set linebreak
set wrap
setlocal spell spelllang=en_us
```

There are many options that are available to you in the `formatoptions` setting, but I'll just note this one for now: a value of '1' causes one-letter words to break a line where you'd expect (based on current word processing idioms). Similarly, enabling the `lbr`, `linebreak` and `wrap` settings sets word wrap and line breaks to break the way you'd expect.

As you'd expect, the '`setlocal spell spelllang=en_us`' incantation enables real-time spell checking. If you're using a plain ASCII terminal, misspelled (and mis-capitalized, etc.) words will be highlighted. Modern terminals will underline the potential mistake.

One other nicety—not a necessity, in my book—is a better wildcard completion when editing a new file. Enabling the `wildmenu` setting (sadly, not what it sounds like), presents a better wildcard menu. Enable it with `set wildmenu`, and then try :e<Space><Tab>. You'll see the difference immediately.

Under Your Skin

Now, if you use all the settings shown so far, Vim is a great word processor. But try to edit code now! It'll look pretty ugly as Vim tries to correct all of your "spelling mistakes." We should

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be able to use Vim as both a word processor *and* programmer's editor, right? Would I be bringing it up if you couldn't?

There are actually several ways to do this, but I'm going to show you the somewhat manual way, and it relies on key mappings. Vim allows you to map any keyboard key to any Vim function. This includes function keys.

A key mapping is generated with the `map` command, and consists of keystrokes that Vim will execute when pressed. You can even think of it more as mini-macros. The following map links F7 to disable spelling and F6 to turn it on:

```
map <F7> <Esc>:setlocal nospell<CR>
map <F6> <Esc>:setlocal spell spelllang=en_us<CR>
```

Note that you do need to include the colon character here if you're supplying a command. A map needs to represent the exact keystrokes you would press, including the final <CR>.

As far as spelling, you may want to leave spelling disabled by default and enable/disable it at will via function keys. Tailor it to your liking.

Going back to being a great code editor, there are some other basic settings we can enable at this stage:

```
syntax enable
filetype on
let is_bash=1
set statusline=%F%m%r%h%w\ [FORMAT=%{&ff}]\ [TYPE=%Y]\
[ASCII=\%03.3b]\ [HEX=\%02.2B]\ [POS=%04l,%04v][%p%%]\
[LEN=%L]
set laststatus=2
```

The syntax enable option gives you what you expect from any code editor: color coded keywords. Setting `filetype on` allows Vim to recognize files by file extension. The `is_bash` variable allows Vim to treat bash scripts with a ".sh" extension properly.

Speaking of things you expect from a code editor, particularly one on the Mac: you expect it to look good! If you've been looking at the screen captures in this article thus far and have thought, "yuck!," there's more we can do!

First, you have to be comfortable with the colors you have set up in your terminal. Terminal.app and iTerm both are customizable in this regard. Let's say you choose a terminal with a black background and white text. Two settings that will *immediately* make things more palatable are:

```
set background=dark
colorscheme evening
```

The first setting simply tells Vim that we're using a dark background. From there, we can load a particular color scheme that defines the colors used for various keywords. You can make your own, but Vim ships with several color schemes ready to use. You'll find them in /usr/share/vim/vim72/colors. Load up a file, and then try different schemes interactively until you find one that is easy on your eyes. Using everything we've come up with so far, editing your ~/.vimrc file in vim will look like the picture in Figure 3.

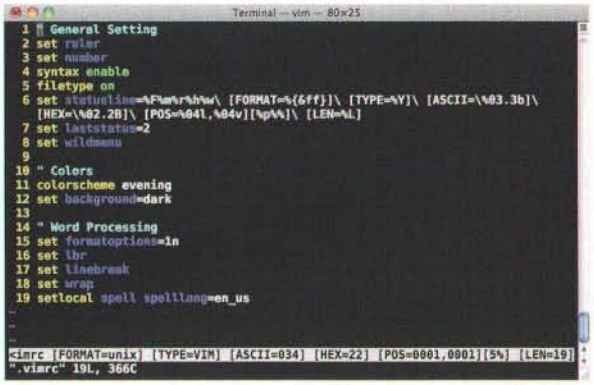

Figure 3: Vim in color

That's much better, isn't it?

Let it Out and Let it In

While we've just scratched the surface with built-in settings, there's another way to modify Vim's behavior: plugins.

Plugins sit in your ~/.vim/plugin directory and are loaded automatically as part of Vim's startup initialization. At their most simple, plugins are just Vim scripts: nothing more than you can already do in ~/.vimrc. At this level, it's a nice way to modularize different functions of all the different bits of configuration. However, there's more, and I need to admit something.

I don't use the version of Vim that ships with OS X. There, I said it. Some of the cooler things you can do with Vim require functionality to be included at compile time. Unfortunately, Apple's version misses many of these additions. There's two ways to get a version of Vim with these extra options.

First, you can go download a pre-compiled version. Particularly attractive is the MacVim distribution. This gives you a GUI (Aqua) version of Vim, along with a command-line version. The pure command-line version is found inside the MacVim.app bundle at Contents/MacOS/Vim. This is the best of both worlds.

Secondly, you can compile your own. Macports makes this particularly easy. I include the +python, +huge, +perl and +ruby variants. If you're already using Macports, this is a logical way to go.

Finally, another little tip: Vim takes advantage of higher color modes of terminals. Apple's own Terminal.app is constrained to 16 colors. iTerm, however, is not constrained in such a way and supports 256 colors. iTerm and Vim in 256 color mode is a wonderful combination. If you go back and forth between iTerm and Terminal.app, there's a nice

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solution to having the best display for each. You can conditionally set the color depth. I have iTerm set $TERM to "xterm-256color" and test for this within ~/.vimrc:

```
if &term ==? "xterm-256color"
  set t_Co=256
  colorscheme evening
else
  colorscheme default
endif
```

You can determine the value to test for by checking for the value of $TERM in your shell.

Back to plugins. Where does one obtain plugins? One place to start is vim.org: there's a huge amount of them on the scripts page (http://www.vim.org/scripts/index.php). Otherwise, you'll typically find them by search once you're using Vim for a while and think, "I wish Vim could (insert wish here)." That's when you find that other people had that wish, too, and did something about it. Most plugins come with instructions on how to install (drop this file in your ~/.vim/plugins directory) and the commands or functionality they enable. Some of my favorites:

MiniBufExplorer: Emulate tabbed editing. Show a 'tab' for each buffer open for editing. Info and download at http://www.vim.org/scripts/script.php?script_id=159.

Snipmate: TextMate style snippets for Vim. If you write any amount of code, Snipmate accelerates . Description and download at

http://www.vim.org/scripts/script.php?script_id=2540

- be sure to watch the video linked to in that page to see it in action.

Taglist: If you're using Vim as a code editor and load anything with more than a handful of functions, you should look at taglist

(http://www.vim.org/scripts/script.php?script_id=273). Taglist shows an overview of code in a separate pane, showing variable names, functions and more.

commentToggle: Toggle comments on and off for a given line or block of text. Information and download at http://www.vim.org/scripts/script.php?script_id=2431.

Again, it's likely that you won't find something until you realize that you need it and go searching.

You'll Begin to Make It

Learning Vim/vi—even just the basics—is really one of the more useful things you can do as a techie. You'll find it on just about every system you touch, certainly all OS X machines. This is especially great when troubleshooting a remote machine over ssh. You won't always have your favorite GUI editor, but Vim will always be available. Vim is the default editor when you create a new account, and will likely remain that if you're on a foreign system. Man pages use vi key bindings to navigate.

If you come to rely on your now customized set up, you can either work in an environment where you always mount your home over the network, or, you can just keep your settings available on a flash drive or someplace accessible. Really, though, for the most part, just learning the basics well (opening files, cursor movement) will serve you in the vast majority of the situations where you'll need it.

Media of the month: Here's a good next step for the people now infatuated with Python after the last few columns – "Python Programming: An Introduction to Computer Science" by John Zelle. This book really focuses on algorithms and high-level practices of computer science. It just happens to use Python as the language for delivery.

Finally, remember that Macworld is only a short time away. MacTech will be there, and we hope to see you, too. It's not too late to make plans to attend.

Until next month, keep practicing!

About The Author

Ed Marczak is the Executive Editor for MacTech Magazine, and has written the Mac in the Shell column since 2004.

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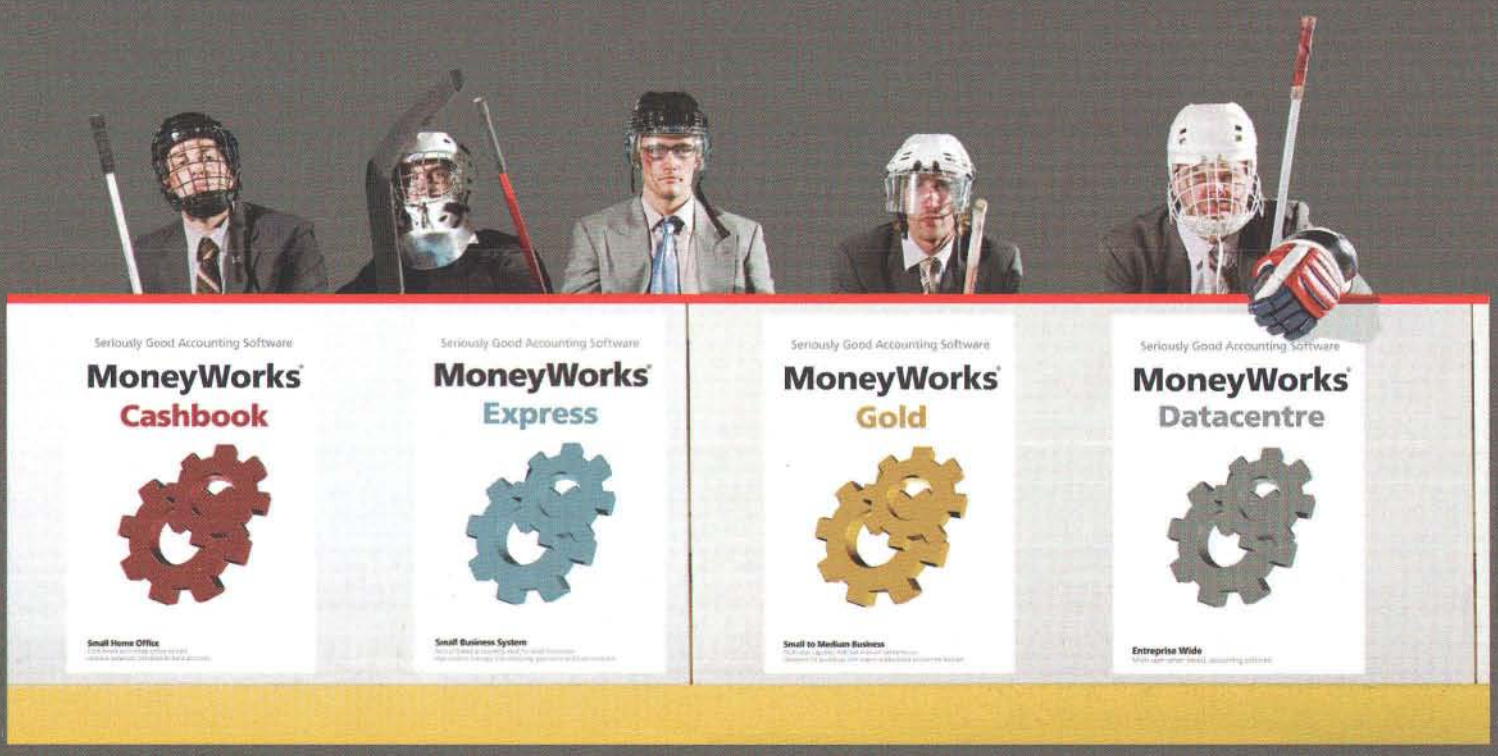

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Packages, Receipts, and Snow...

Snow Leopard's changes to package receipts and updates

By Greg Neagle, MacEnterprise.org

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Introduction

It's that time of year, when there's snow (at least in parts of the Northern Hemisphere), and people are thinking of packages – packages to ship to friends and family; maybe even packages under a tree. So what better time to talk about Snow *Leopard* and packages?

As always, with each major OS release from Apple, there are changes that might affect systems administrators. Last time, we went on a scavenger hunt through the OS, looking for some of these changes. This month, we'll focus on changes relating to installer packages, receipts, and Software Update.

Keep Those Receipts!

Experienced OS X systems administrators should be familiar with package receipts. These are written to disk when software packaged in Apple package format is installed. Receipts serve as evidence that a certain version of a certain software package has been installed, and also are essential for the installer when it is upgrading a software package from an older version to a newer version. Some software installation problems can be resolved by removing the relevant receipt(s). If the receipt is missing, the installer treats the installation as a new install instead of an upgrade install. (This may create its own issues; it is not something you should do as a matter of habit.)

Prior to the release of OS X 10.5 Leopard, when Apple packages were installed, receipts were left in `/Library/Receipts`. These receipts were copies of the original installation package minus the archive containing the actual files that were installed.

Leopard added a new type of package – the "flat" package – where instead of a bundle-style directory, the package is a single file. This file is actually a XAR archive; similar in concept to a "tarball" or zip archive. When this type of package is installed under Leopard, it does not leave a receipt in `/Library/Receipts`. Instead, a copy of the "bom" (bill-of-materials) file is placed in `/Library/Receipts/boms`, and an entry for the package is made in the package database. You can get information from the package database using the `/usr/sbin/pkgutil` tool.

Even though OS X 10.5 introduced a new package format, there's still plenty of software that uses the older format. Any software that can be installed on OS X 10.4 or earlier **must** use the older bundle-style package format. Many vendors continue to use the bundle-style package format even for software that runs only on 10.5 and later, because this format is well understood and there are several third-party tools to create this format. Under Mac OS X Leopard, packages in this format leave their receipts in `/Library/Receipts` – just as they did in previous releases of Mac OS X – so you might have to look in two places and use a variety of tools to find the receipt information you are interested in.

In Snow Leopard, virtually all package receipts now go in the package database, and only extremely old package formats or those missing the `CFBundleIdentifier` attribute from their `Info.plist` are not added to the package database. If you haven't had to work with the package database before, under Snow Leopard, you almost certainly will.

Pkgutil

If you had previously dug around in package receipts to figure out exactly what was installed, and examined pre- and post-install scripts to puzzle out what additional changes were made when software was installed, you may wonder how to get that information under Snow Leopard. Some of the info is now available via `/usr/sbin/pkgutil`, but for pre- and post-install scripts, you'll need to find the original installer package – this information is no longer retained.

If you used `pkgutil` in Leopard, it is mostly unchanged in Snow Leopard. Here are some common uses of `pkgutil`:

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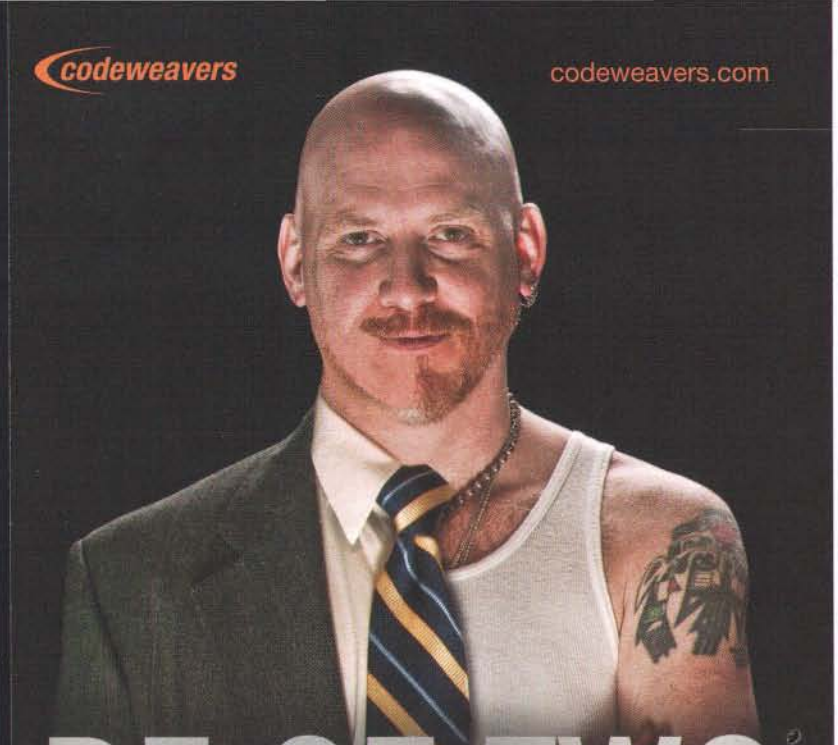

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`pkgutil --pkgs` will list all installed package IDs. By using the `--volume` option, you can query the package database on a volume other than the boot volume.

```
pkgutil --pkgs
com.adobe.pkg.FlashPlayer
com.adobe.shockwave
com.apple.pkg.AdditionalEssentials
com.apple.pkg.AdditionalSpeechVoices
com.apple.pkg.AddressBook
...
```

`pkgutil --files` *packageid* shows all the files installed by *packageid*.

```
pkgutil --files com.adobe.pkg.FlashPlayer
Flash Player.plugin
Flash Player.plugin/Contents
Flash Player.plugin/Contents/Info.plist
Flash Player.plugin/Contents/MacOS
Flash Player.plugin/Contents/MacOS/Flash Player
Flash Player.plugin/Contents/Resources
Flash Player.plugin/Contents/Resources/English.lproj
...
```

`pkgutil --pkg-info` *packageid* prints extended information about *packageid*.

```
pkgutil --pkg-info com.adobe.pkg.FlashPlayer
package-id: com.adobe.pkg.FlashPlayer
version: 10.0
volume: /
location: Library/Internet Plug-Ins
install-time: 1255647844
```

`pkgutil --forget` *packageid* removes info about *packageid* from the package database. This is equivalent to deleting receipts in `/Library/Receipts` under older versions of Mac OS X, and is a way to get the installer to treat a reinstall like a new install instead of an upgrade install. Note that this does not remove any files installed by the package.

```
pkgutil --forget com.adobe.pkg.FlashPlayer
Forgot package 'com.adobe.pkg.FlashPlayer' on '/'.
```

`pkgutil --file-info` *path* will print information about the filesystem item at *path*. This can be useful for determining which package is responsible for installing a specific file or directory.

```
pkgutil --file-info /Applications/Mail.app
volume: /
path: /Applications/Mail.app

pkgid: com.apple.pkg.Mail
pkg-version: 10.6.0.1.1.1249291854
install-time: 1251997001
uid: 0
gid: 0
mode: 755

pkgid: com.apple.pkg.update.os.10.6.1
pkg-version: 1.0.1.1249367152
install-time: 1255646935
uid: 0
gid: 0
mode: 755
```

We can see that the `/Applications/Mail.app` directory was installed as part of the `com.apple.pkg.Mail`

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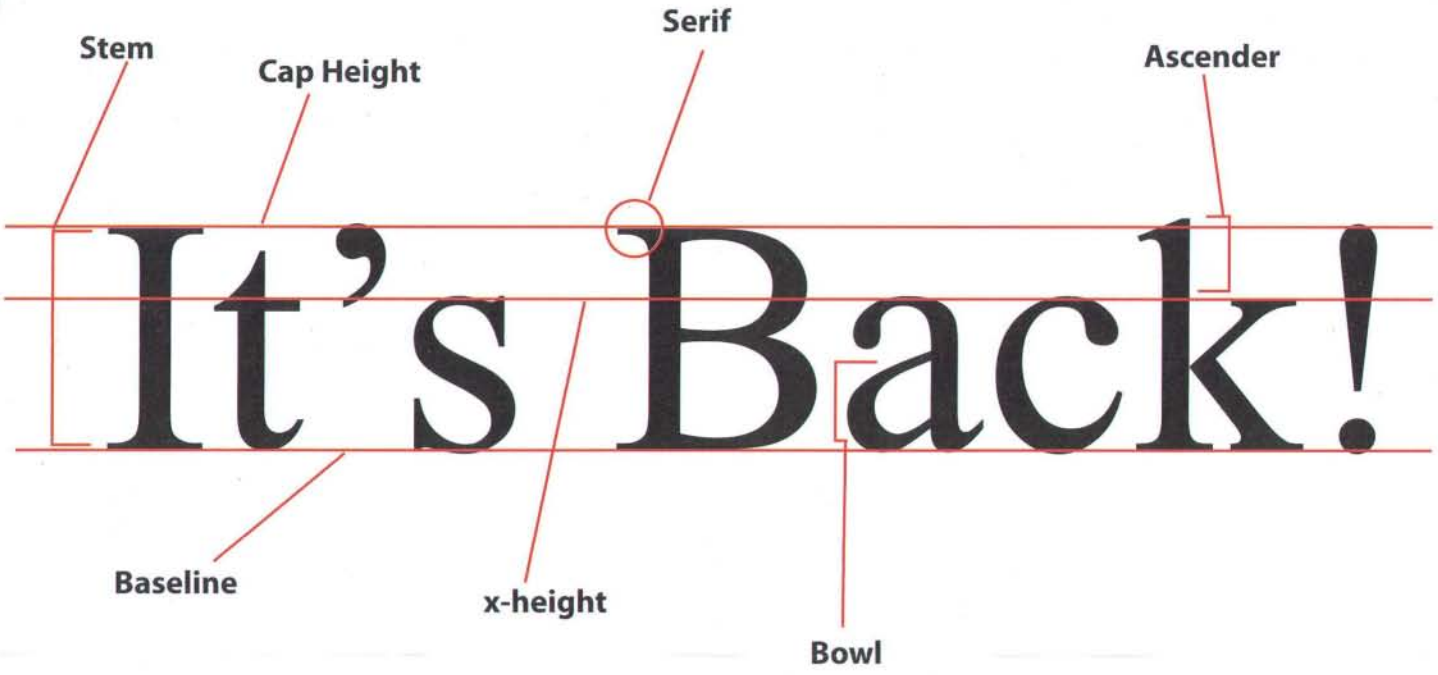

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package as part of the original OS install, then later modified by the 10.6.1 update.

In Leopard, the actual package database was a Sqlite3 database, stored on-disk at `/Library/Receipts/db/a.receiptdb`. You could use standard sqlite3 libraries to query and even modify this database. In Snow Leopard, it appears the database is created from the contents of `/var/db/receipts`. In this directory you will find two files for each installed package – a `packageid.bom` file, and a `packageid.plist` file. The bom file is a standard bill-of-materials file, containing a listing of all the filesystem items installed by the package. You can use lsbom to list the contents of the bom file. The plist file is, of course, a standard OS X property list file, containing metadata about the package. The plist file is in binary format, so to read it you'll either need to use the `defaults` command, or use `plutil` to convert it to XML. Here we'll use the `defaults` command:

```
defaults read /var/db/receipts/com.microsoft.rdc.pkg
{
    InstallDate = "2009-10-14 15:43:47 -0700";
    InstallPrefixPath = "";
    InstallProcessName = installer;
    PackageFileName = "RDC2.0.0.pkg";
    PackageIdentifier = "com.microsoft.rdc.pkg";
    PackageVersion = "2.0.0";
    PathACLs =      {
        Applications = "!#acl 1\\ngroup:ABCDEFAB-CDEF-ABCD-
EFAB-CDEF0000000C:everyone:12:deny:delete\\n";
    };
}
```

This appears to be a superset of the info you can get from `pkgutil`:

```
pkgutil --pkg-info com.microsoft.rdc.pkg
package-id: com.microsoft.rdc.pkg
version: 2.0.0
volume: /
location:
install-time: 1255560227
```

Note that the plist file for `com.microsoft.rdc.pkg` contains a little more information – the filename of the installer package; which process installed this, and ACLs for any paths in the installed payload. Also, the install date/time is in a more human-readable format in the plist file.

As always, you can type `man pkgutil` at a command-line prompt to get more information on the syntax and options for `/usr/sbin/pkgutil`.

Software Update

Software Update has not changed much from Leopard. One annoyance from Leopard has been fixed, though.

In Leopard, Software Update could be configured to automatically download available updates in the background, and then notify you when they were ready to install. These updates were stored in `/Library/Updates`. But if you used the command-line version of `softwareupdate` to download available updates, the updates were downloaded to the `Downloads` folder of the current user, even when that user was root. This was a minor thing, sure, but was annoying in its inconsistency.

Snow Leopard changes this behavior. `/usr/sbin/softwareupdate` now downloads updates to

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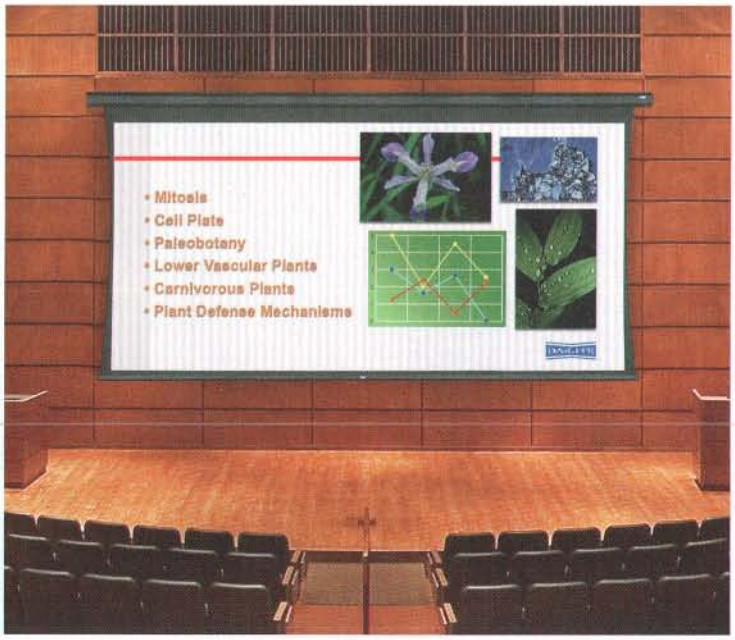

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`/Library/Updates`. This makes it easier to script custom behavior for downloading updates, as updates downloaded by a script using `/usr/sbin/softwareupdate` appear in, and can be installed with the GUI Software Update application.

Software Update Server

If you manage an Apple Software Update Server for your organization, in order to serve updates to Snow Leopard clients, Apple's official stance is that you'll need to upgrade to Snow Leopard Server on your Software Update Server machines. This is not a new requirement; the Leopard update required a matching update on the server end, as did Tiger.

What's frustrating about this is there is no real technical reason for it, as Apple's Software Update service is just a specially configured web server and some code that replicates updates from Apple's servers to yours. You may not be ready to upgrade your server infrastructure at the same time you need to roll out client machines running Snow Leopard.

What to do? You could configure your Snow Leopard clients to get their updates directly from Apple. You could set up a new Snow Leopard-only software update server on some spare box you have – Apple's new pricing on Snow Leopard server makes that more appealing than in the past. Or you could go the super-cheap route and hack your Leopard Software Update server.

Software Update Server Hack

The original hack was described by Jan Uschok on an Apple discussion list here:

http://discussions.apple.com/thread.jspa?threadID=2169042&tstart=0

All credit for this hack should go to Jan, and I recommend you read the original hack and discussion if you want to try this. In case the discussion disappears, the basic steps follow:

Stop your Software Update Server process.

On your Software Update Server, create a file at `/usr/share/swupd/html/content/meta/mirror-config-1.plist` with the following contents (you may need to create the "meta" directory if it is missing):

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple Computer//DTD PLIST
1.0//EN" "http://www.apple.com/DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
    <key>PrimaryCatalog</key>

<string>http://swscan.apple.com/content/catalogs/index.sucata
log</string>
    <key>CatalogsList</key>
    <array>

<string>http://swscan.apple.com/content/catalogs/index.sucata
log</string>

<string>http://swscan.apple.com/content/catalogs/others/index
-leopard.merged-1.sucatalog</string>

<string>http://swscan.apple.com/content/catalogs/others/index
-leopard-snowleopard.merged-1.sucatalog</string>
    </array>
</dict>
</plist>
```

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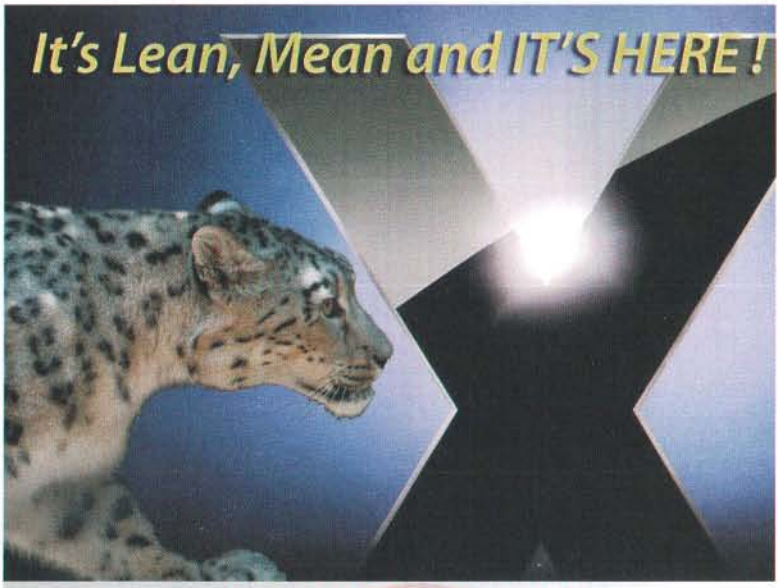

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If you retype this from this magazine, note that there should be no line breaks inside any of the `<string>` elements – they are all a single line.

Edit `/etc/swupd/swupd.plist` and change the `metaIndexURL` entry to look like this:

```
<key>metaIndexURL</key>
<string>http://localhost:8088/content/meta/mirror-config-1.plist</string>
```

Again, mind the line breaks; the <string> element is a single line.

Start the Software Update Server process and wait for it to download the catalogs. They'll appear under `/usr/share/swupd/html/content/catalogs/` and `/usr/share/swupd/html/content/catalogs/other/`

Once the new catalogs are in place, stop the Software Update Server process again.

Create some symlinks:

```
cd /usr/share/swupd/html
ln -s
/usr/share/swupd/html/content/catalogs/index.sucatalog .
ln -s
/usr/share/swupd/html/content/catalogs/others/index-leopard.merged-1.sucatalog .
ln -s
/usr/share/swupd/html/content/catalogs/others/index-leopard-snowleopard.merged-1.sucatalog .
```

(Again, watch the line breaks; all `ln -s` commands are a single line)

Start the Software Update Server process (again!) and wait for updates to download.

At this point, your hacked Software Update Server should be acting like a Software Update Server running on Snow Leopard server. You can then configure your clients as described on pages 88-89 of the Server System Imaging and Software Update Administration Guide for Snow Leopard. This guide is available from Apple here:

http://images.apple.com/server/macosx/docs/System_Imaging_and_SW_Update_Admin_v10.6.pdf

Specifically, you need to point Tiger clients to one Software Update URL; Leopard clients to another URL, and Snow Leopard clients to yet another.

Use this hack at your own risk; Apple could make changes that would cause this to stop working, and there's no guarantee that the Leopard Server Admin GUI tools will do the right thing with your hacked Software Update Server.

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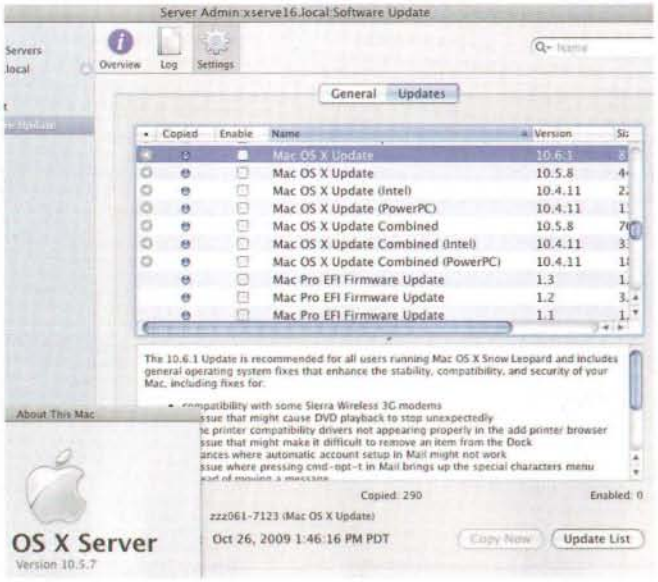


Figure 1 – Leopard Server hosting Snow Leopard updates.

Figure 1 is a screen shot showing a hacked Leopard server hosting Snow Leopard updates. You can see there vvvare updates available for Tiger, Leopard, and Snow Leopard. For comparison, see Figure 2, which is a Snow Leopard server hosting the same updates.

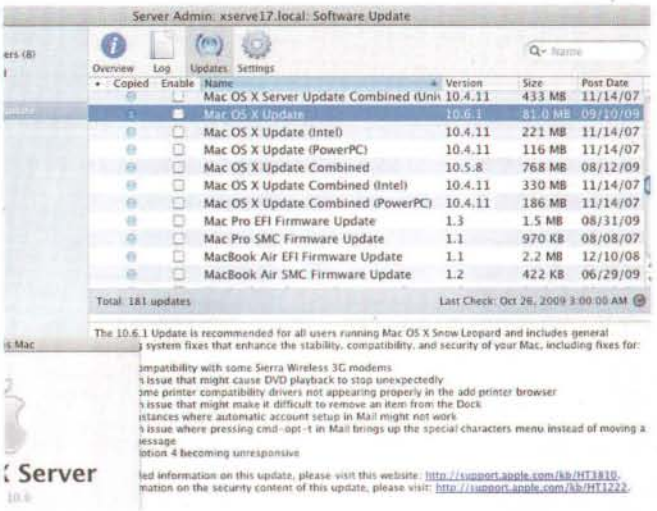
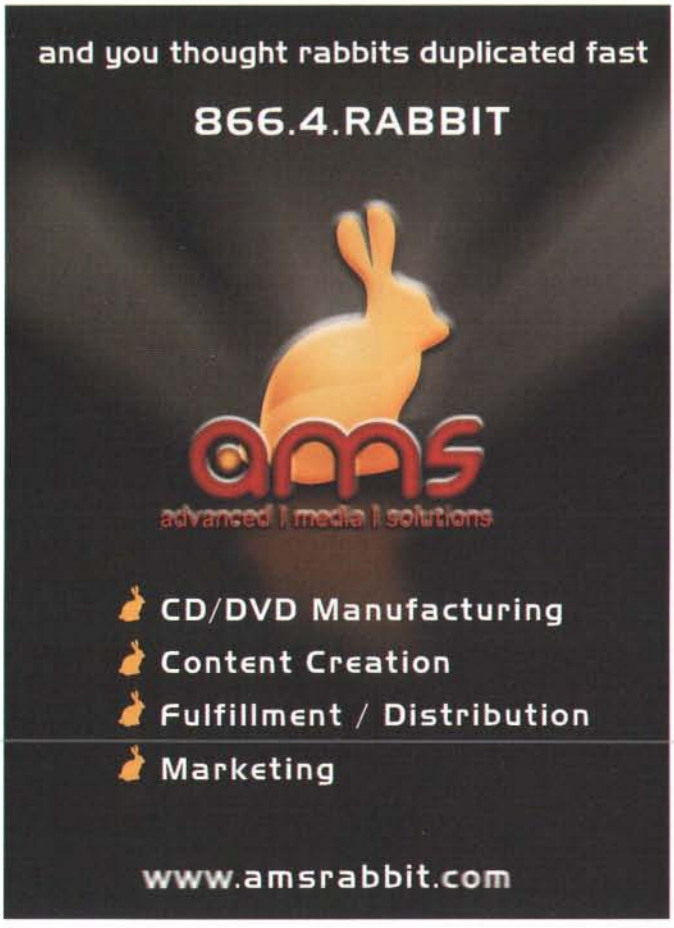


Figure 2 – Snow Leopard server running S oftware Update Server.



In my brief testing, this hack seemed to work as desired, but I'm not certain I'd want to rely on it indefinitely. Your mileage may vary; results shown may not be typical; talk to your doctor to see if Software Update Server hacking is right for you.

Wrapping up

That completes our look at Snow Leopard, receipts, packages, and Software Update. As with most of the changes between Leopard and Snow Leopard, the changes in handling packages and receipts aren't dramatic; they are more evolutionary than revolutionary. We'll all have to wait for Mac OS X 10.7 to see if revolutionary changes are in store – like for example:

```
pkgutil -uninstall packageid
```

A systems administrator can dream!

About The Author

Greg Neagle is a member of the steering committee of the Mac OS X Enterprise Project (macenterprise.org) and is a senior systems engineer at a large animation studio. Greg has been working with the Mac since 1984, and with OS X since its release. He can be reached at gregneagle@mac.com.

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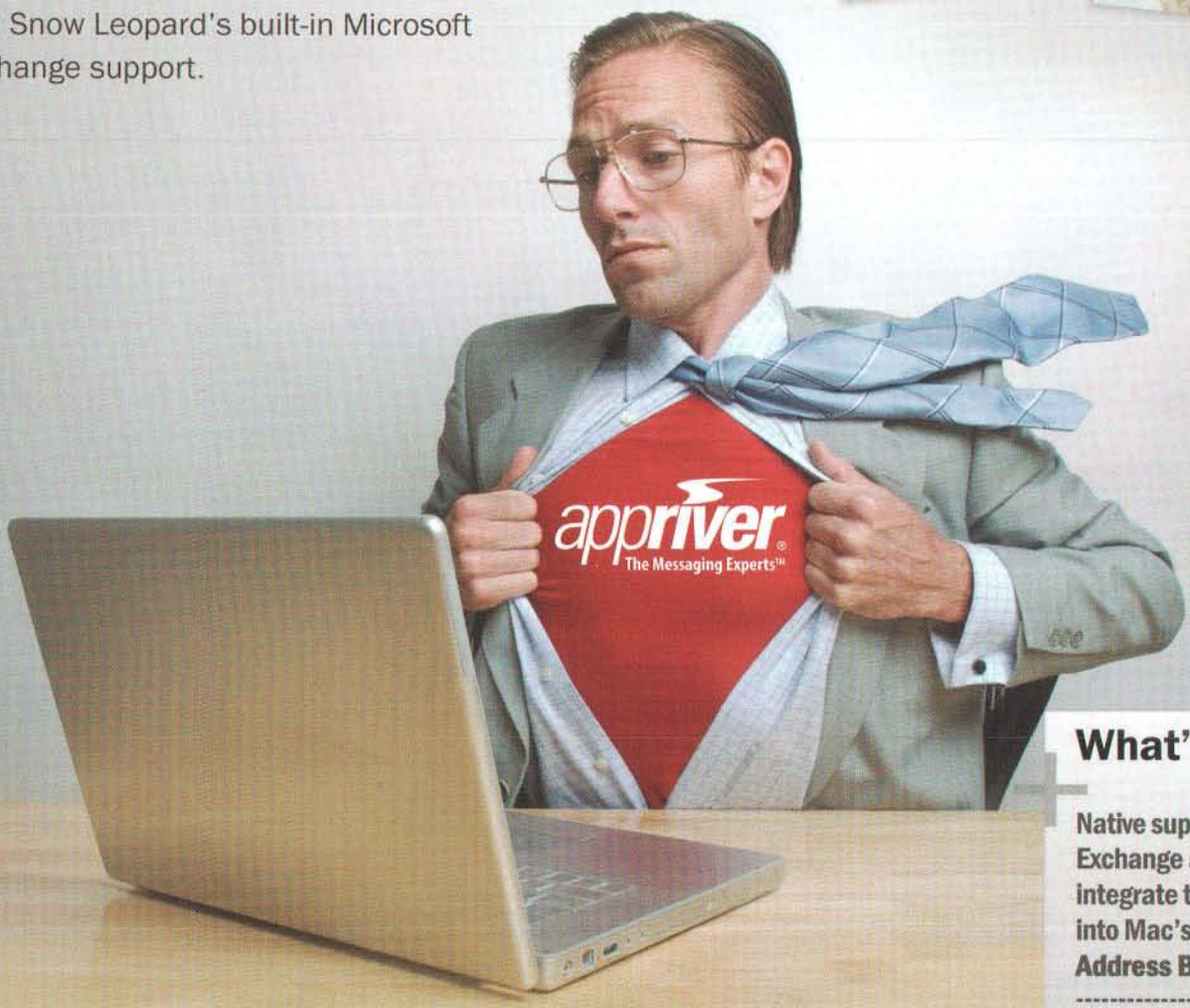

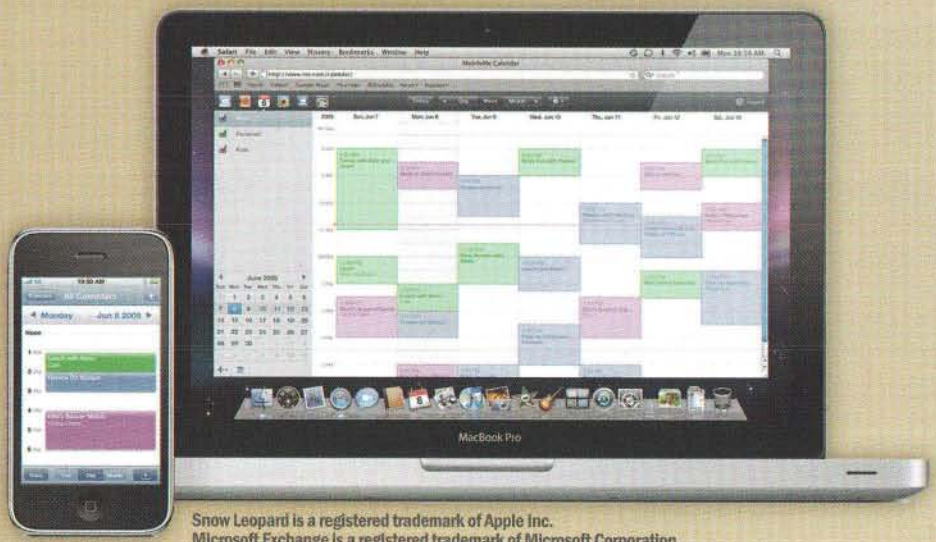

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It's been 25 years already? Really? Wow! So many fond memories. My love affair with Apple started a few years before the Mac was born. I had a company that did Pascal and assembler development on the Apple II. Amazing what you can do in 48K with a bit of floppy swapping.

The moment the Mac was announced, I knew I had to have one. I was living in Colorado in 1984 and I managed to find a local computer shop that sold the Apple II and was willing to order a Mac 128K for me. I remember a sense of urgency, cause if you ordered during the first 30 days, you got a free copy of MacWrite and MacPaint. Seems to me, the folks who got their Macs later in the year also got free copies of MacWrite and MacPaint. But oh well, worth it nonetheless.

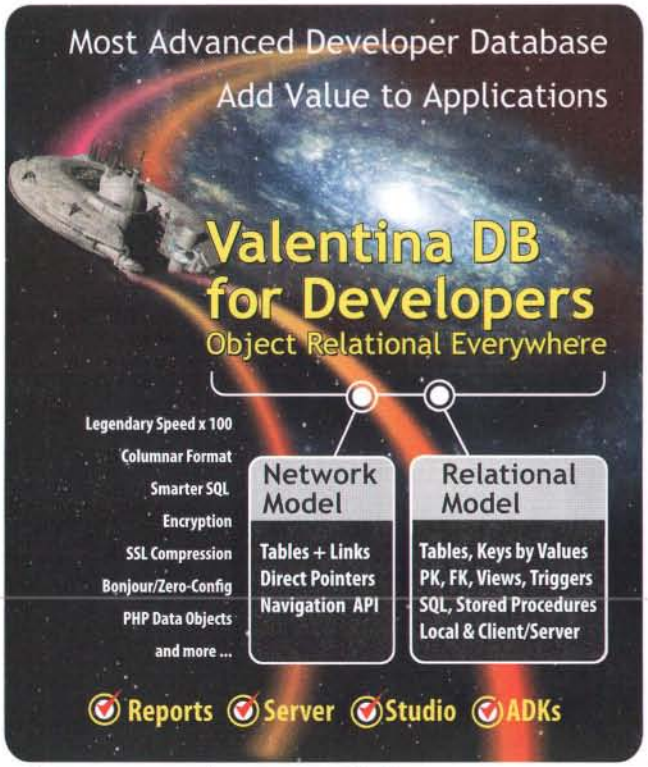
When my Mac arrived, my life ground to a standstill as I immersed myself in this amazing new environment. I had worked with the Alto at Xerox Parc (the Alto was a predecessor to the Mac/Lisa), so I had a sense of life with a mouse, but the Mac brought that experience to life in a completely different way. The square pixels, incredibly sharp display, and focus on design really brought the Mac to a whole new level. It was love at first sight.

After a honeymoon period as a user, I set my sights on building an app for the Mac. As an Apple Certified Developer (that's what us Apple II devs were called), I received regular mailings from Apple with loose leaf pages of Pascal-oriented development notes covering the Toolbox. These would eventually become Inside Macintosh.

Having cut my teeth on C, I eventually found Manx Software's Aztec C compiler for the Mac. Hugely fun. I eventually worked on a disassembler for Manx, though not sure if that ever shipped.

Over time, Aztec C yielded to Lightspeed Pascal, then Lightspeed C, then my favorite of all of these, Code Warrior from MetroWerks. I still have my first few Code Warrior disks. I think I started writing my Getting Started column for *MacTech* just about the time MetroWerks was forming. Those early days of Mac dev were incredibly exciting. Much like the iPhone dev universe is today, though the iPhone has much better documentation. Thanks goodness for that!

Good times, good times. Thanks *MacTech* for letting me share in these great memories...



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CSI: Crash Scene Investigation

EXAMINING CRASHES TO CATCH THE CULPRIT

by David Garcea

The 911 Call

You've written an application. Great! However, every application will crash eventually. Every crash is a mystery waiting to be solved, and the deduction and experimentation required to solve it can make you feel like Gil Grissom, but first you must know it happened. When an application crashes, the Crash Reporter will gather information about it and send it to Apple. This works great for Apple's products, but it doesn't help third party developers. You will have to do some coding to redirect this information to you. There are several packages that you can use to accomplish this, or you can do it all yourself. Here are a few of the free, ready-made options:

- *Smart Crash Reports* by Unsanity is an InputManager-based enhancement for Apple's Crash Reporter application, which causes the crash report to be posted to a CGI on either your web server, or on Unsanity's server, as well as sending it to Apple.
  http://www.smartcrashreports.com
- *HDCrashReporter* resides solely inside your application, but requires the user to relaunch your application after a crash, in order to email the report to you. The source code is available under the GNU Lesser General Public License, so you can customize it.
  http://www.profcast.com/developers/HDCrashReporter.php
- *ILCrashReporter* is a framework that contains a custom CrashReporter application. When you start your application, you launch the CrashReporter and it watches your process for unexpected termination. When a crash occurs, the crash report and console log are emailed to you. The source code for both the framework and application are available.
  http://www.infinite-loop.dk/developer

If you choose one of the above options, you may still want to expand on the information they gather. To avoid delays caused by going back to ask for more information, get everything you might need all at once. In addition to the crash report, you should acquire a system profile to determine which environments are susceptible to the crash, and therefore how many users are likely to be affected by it. You should also get the console log, which may hold only a single line that pertains to your program, but that line often pinpoints the problem. These files can be obtained automatically, so that all the user must do is permit the information to be sent to you. The less they have to do, the more likely they are to report the crash. Consider providing a way for the user to describe the incident as well. They witnessed it, so they may know something crucial to reproducing it. You will also want to note the name and contact information of the reporter, so that you can ask for more information if necessary, and get confirmation once you have fixed it.

The Witness Interview

Eyewitness statements are even more unreliable in the technology industry than they are in criminal investigations. While the witness statement could provide the clues that you need to solve the problem, they could also contain misused terminology, specious assertions, and misleading statements. Always examine what the witness said, and stay open to it as a possibility, but do not to assume any of it is accurate.

The problem with witness statements is the difficulty inherent in describing in words what is seen on the screen. To circumvent this, ask the reporter to take a screenshot of your application the moment before they reproduce the crash. You will notice the details that the reporter did not think to mention. At Telestream, we take this further and ask our Quality Assurance department to use ScreenFlow to record a video of the steps leading up to a crash or bug, which is better than a single picture, as it shows you the state of the program at each step. You could use the free demo of ScreenFlow (http://www.telestream.net/screen-flow), or Jing (http://www.jingproject.com) to do the same.

The Victim's Wallet

Once you have all of the documentation, examine it, starting with the crash report, which contains sections describing the process, the report, the crash, the threads, the registers, and the binaries.

The Process section contains identifying information about the process that crashed, including the name, process

identification number, how the process was launched, and the executable path for the process.

Ensure that the identifier matches one of yours. If it does not, then the crash is out of your jurisdiction and you cannot fix it. Inform the reporter to send it to the appropriate party.

After the process name is a number in brackets. This is the process identification (PID) number that was assigned to the process when it started. Every process is given a number, starting with zero, and incrementing for each new process that is launched. If this number is high, you know that a lot of processes have been run since the last time the computer booted up, which suggests that the computer has been running for a while without a restart.

Next is the path to the executable for this process. If this is a location that you did not expect, investigate how your program behaves when run from this location. The user may have been running from a locked disk image, or in a directory where they did not have proper permissions, both of which could cause problems if your code is not designed to handle these situations.

The version number of your product is next, and it is essential in correlating the crash to a specific version of your code. The standard Mac version number scheme contains a major version, a minor version, and a bug fix number. This scheme lacks one essential feature. It does not provide a unique identifier for each and every build. Consider using a scheme that consists of the major version, minor version, bug fix number, and build number, thereby assigning a single unique identifier to each and every build. You can then correlate this number to the date and time that a build was made, and then retrieve the exact version of every source file used to make that build from your source control management system. This will save time that might otherwise be lost by trying to reproduce a crash with the wrong source code.

The code type specifies whether the PowerPC or Intel code inside your universal binary was the one that crashed. If you have code written for a specific architecture, such as AltiVec or SSE, this will tell you which was executed.

The parent process tells you how your application or plug-in was launched. For applications, this is typically *launchd*. If your product was launched by another process, it may have been in an environment or workflow that you had not anticipated.

The Crime Scene

The report section includes the date and time that the crash occurred, which can be used to correlate the crash with the console log, as most of its entries are time-stamped. You can then focus on the log entries immediately prior to the time of the crash.

The version of the operating system is important for reproducing issues, as they may be specific to a certain version of Mac OS X. If it is a new version of Mac OS X that was released after this version of your software, or if it is a very old version of MacOS X, this could signal an incompatibility.

Lastly, the report version describes the format of the crash report, for use by automated analysis programs.

The Cause of Death

Crashes are caused by exceptions. The crash section describes the exception that caused the crash using two identifiers: the exception type, which is the category for the exception; and the exception code, which is the specific identifier. The most common exception types are EXC_ARITHMETIC, EXC_BAD_INSTRUCTION, and EXC_BAD_ACCESS. The line for the exception code may also include the offending address or value that caused the exception. The last item is the number of the thread that was executing when the exception was encountered.

The EXC_ARITHMETIC exception type covers any arithmetic that is considered illegal, such as dividing by zero (EXC_I386_DIV). Mathematically, the result of a division by zero is undefined. Intel processors are strict when it comes to dividing by zero, and they will not allow it. PowerPC processors were more forgiving, albeit mathematically incorrect. Instead of causing a crash, they returned zero as the result.

Listing 1: ExceptionController.m

Divide By Zero

The following demonstrates causing an EXC_ARITHMETIC/EXC_I386_DIV (divide by zero) exception. Note that the compiler will warn you if it sees that you are trying to do a divide operation with a literal constant of zero as the divisor. However, it will not catch situations where a variable with a value of zero is used as the divisor.

```
int divisor = 0;

// This line will cause the exception on an Intel processor.
int result = 128 / divisor;

// Modulus operations use division, so they can
// also cause this exception.
result = 128 % divisor;
```

The EXC_BAD_INSTRUCTION exception type means that the processor was given an instruction that it does not understand. This means that your code has corrupted the instruction pointer, which is a register that points to the memory location that holds the next instruction to execute. When that pointer is corrupted it points to some other part of memory and the processor tries to interpret that memory as an instruction, when it was intended to be something else.

In order to prevent a problem in one program from crashing other programs, or even the entire system, Mac OS X uses protected memory. Every process is given a virtual address space, which is divided into segments. Each segment has permissions that specify whether you can read from it, write to it, or execute it. When you allocate memory, it is mapped from the physical address that it resides on to the virtual address that is given to your program. The EXC_BAD_ACCESS exception type means that your program attempted to access memory that either was not mapped (KERN_INVALID_ADDRESS), or was not allowed to access (KERN_PROTECTION_FAILURE) because of the permissions on that segment. To examine the virtual memory maps for your

application, pass the PID of your application to the *vmmap* command line tool.

Listing 2: ExceptionController.m

Kernel Invalid Address

The following demonstrates causing an EXC_BAD_ACCESS/ KERN_INVALID_ADDRESS exception.

```
// On 32-Bit systems, each process can have up to 4GB of
// memory. Here, we try to write to the very last byte,
// which is neither likely to be mapped already, nor
// mapped by us via allocation. While you aren't likely
// to explicitly do this in application, if you try to
// write to a pointer that has been corrupted, you may
// end up doing just this.
memcpy( (void *)0xFFFFFFFF, "d", 1);
```

Listing 3: ExceptionController.m

Kernel Protection Failure

The following demonstrates causing an EXC_BAD_ACCESS/ KERN_PROTECTION_FAILURE exception.

```
// Trying to write to a NULL pointer will cause this
// exception, as memory address zero resides in a
// virtual memory segment called "__PAGEZERO", which
// does not allow write access.
long *badPointer = NULL;

// This line will cause the crash.
*badPointer = 0xFEEDFACE;
```

Now that you know how to cause these bugs, you will be better prepared to find them and fix them.

The Corpse

The body of the crash report is the threads section. This shows the call stack for every thread in your program when your process crashed. Each entry in the call stack contains a number defining its position in the stack, a universal type identifier, the address of the function, the function name, and the offset to the instruction that caused the crash. The first line is the function that the thread was in at the time of the crash. The identifier tells you what binary contains that function. If the identifier in the first line of the call stack for the crashed thread is not the identifier for your application, you can check the Binary Images Description portion of the crash log for more information on that binary. We will cover more on that section later.

Threads can either be actively executing, or blocked, waiting to execute. Determining which threads were active at the time of the crash and which were blocked, will allow you ferret out the potential culprits. Consider any thread that was blocked to have an alibi. Any thread, whose current function name contains one of the following words, was most likely blocked: wait, delay, semaphore, mutex, and sleep.

If you notice a thread with one or more function names repeated, particularly if the call stack is very deep, the exception might be caused by runaway recursion. Recursion is when a function calls itself, either directly or indirectly. This can be quite

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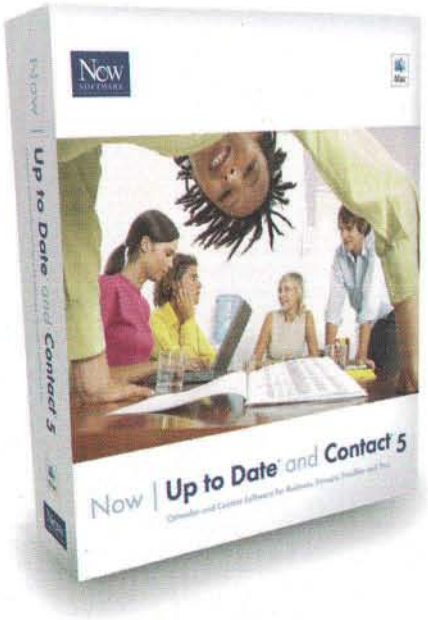

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useful technique, particularly when dealing with hierarchical data, but if left unchecked, the recursion could keep going until it uses up all of the available memory, which will cause a crash. Recursion can also happen unintentionally, for instance, if you call were to call `[self display]` in the drawing routine of a custom view.

If you see question marks in place of the binary identifiers, you could have a stack corruption. These can be difficult to solve because the application will continue to run after the memory has been corrupted, crashing instead in code that is executed much later. If you suspect you are dealing with a stack corruption, try turning on stack canaries in Xcode by adding the –fstack-protector (or –fstack-protector-all) flag to the "Other C Flags" setting for your project. Stack canaries work like a canary in a coal mine, as an early warning system. When stack canaries are on, the integrity of the stack is checked when you return from a function. If the stack has been corrupted, an error message is printed to the console to help you find the problem.

Multithreading problems are also difficult to track down because the crashes may only happen a small percentage of the time, and the offending code might not be the in the thread that crashed. Your best resource for these types of issues is collecting multiple crash logs and comparing them together. If you find the same two threads are always in similar locations when the crash occurs, try checking for unsynchronized access to shared resources, which is usually the culprit. Check your semaphores, and mutexes, to see if there is a case you might have left vulnerable to simultaneous access.

The Brain

After the threads section, you will find a table listing the registers and their values at the time of the crash. The x86 processor architecture designates eight registers for general purposes, six segment registers for memory management, a flags register to describe or control the results of operations, and the instruction pointer, which holds the address of the next instruction to execute. Not all x86 registers are listed in the crash report, but the ones that are can provide clues as to the cause of the crash.

x86 General Purpose Registers Listed In Crash Reports

Register (32 Bit / 64 Bit)		Purpose
EAX	/RAX	Accumulator
EBX	/RBX	Base
ECX	/RCX	Counter
EDX	/RDX	Data
EDI	/RDI	Destination Index
ESI	/RSI	Source Index
EBP	/RBP	Base Pointer
ESP	/RSP	Stack Pointer

While the general-purpose registers can be used for anything, most have certain tasks that they are optimized for. The accumulator is where most arithmetic calculations are performed.

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The base register has no specialized purpose. The counter register is designed for use as the index in loops. The data register is for storing data used in the calculations occurring in the accumulator. The destination index is for use as a pointer to the current location in a write operation. Similarly, the source index is for use as a pointer in a read operation. The base pointer points to the bottom of the stack, and the stack pointer points to the top of the stack.

x86 Other Registers Listed In Crash Reports

Register	Purpose
SS	Stack Segment
EFL/RFL	Flags
EIP/RIP	Instruction Pointer
CS	Code Segment
DS	Data Segment
ES	Extra Segment
FS	F (Extra) Segment
GS	G (Extra) Segment
CR2	Control Register 2

The remaining registers have dedicated purposes. The segment registers are for supporting memory protection via segmentation. However, paging is now the preferred method of memory protection, so most of these registers are set to the same value. The F and G segments may store data specific to a thread. The flags register is used to control the results of operations, and to store information about those results, such as if the result overflowed the register. CR2 contains the offending address when a page fault occurs.

The Known Associates

The Binary Images Description section of the crash report has a list of all of the binaries involved in running your application, including the frameworks, plug-ins, and dynamically-linked libraries. There is one line per binary, and each entry contains the memory address span, the identifier, the version, and the file path it was loaded from. This list is usually long, even for the most trivial applications. If your application uses plug-ins, look for them here to see what versions were present.

If you are having trouble finding the cause of your crash, it is worth taking a few minutes to review this list. Look for anything that is unusual, meaning any entry whose identifier is neither yours nor Apple's (i.e. com.apple.whatever). When you find one that you do not recognize, look it up online. If it seems like it could interfere, try uninstalling it and see if the problem disappears.

The Modus Operandi

Some bugs cause immediate crashes, such as the EXC_I386_DIV exception, others start causing problems that will lead to a crash. If the crash happens at the same line of code every time it is executed, it is probably going to be easy to fix. If, however, the crash only happens occasionally, or at different lines of code, then it is a delayed crash, and will be

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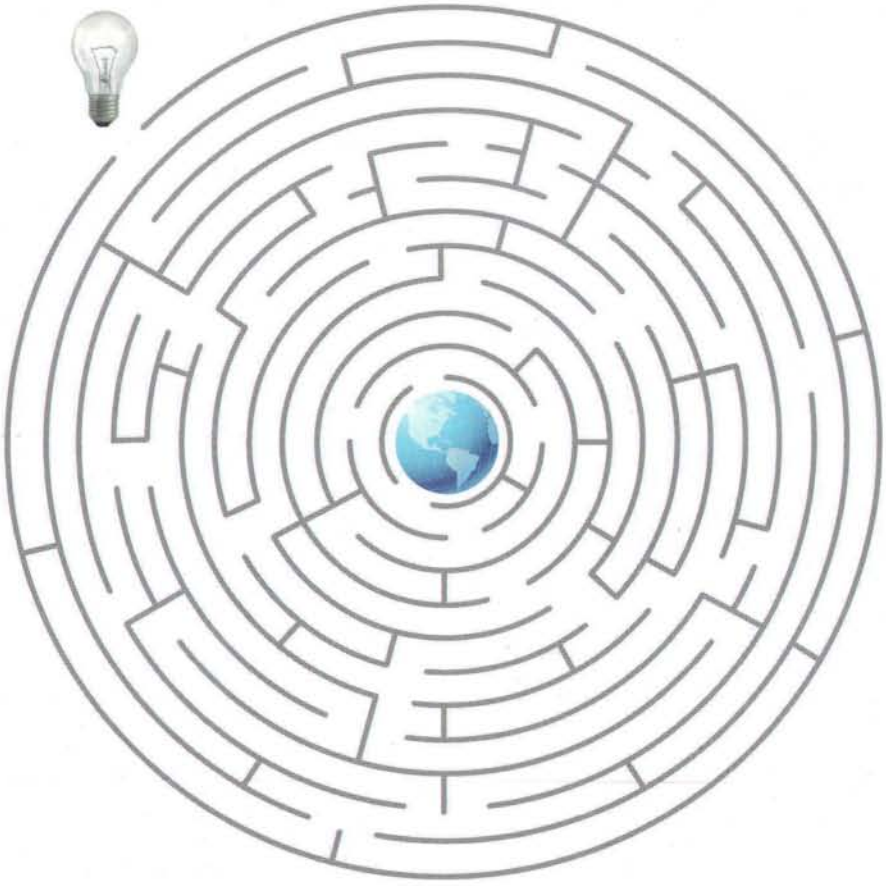

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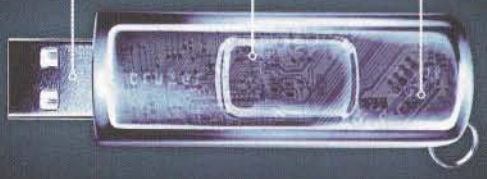

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tougher. To fix these issues, you will have to backtrack and find the initial problem.

To tackle delayed crashes, there are several techniques you can use to narrow down the problem. Law enforcement has a better chance of catching a serial killer each time he commits a new murder because each incident provides the investigators with more information. Similarly, the more instances of the crash you have to examine, the easier it will be to solve. Collect documentation for multiple instances of the crash and compare them, using your favorite diff tool. The information that is the same may be the conditions that are required to cause the crash, which are hints to the cause. You can also use this technique to exclude unrelated crash reports, if they are dramatically different than all of the others that you have collected on the issue.

The Reenactment

Your goal now is to be able to reliably reproduce the crash. If you cannot, you will never be able to verify that it was fixed, so you might as well drop it in the cold case drawer.

The next step is reducing the time it takes to reproduce the crash to under a few minutes. If the crash takes an hour to occur, it will take an eternity to investigate it.

If appropriate, try stressing the program by reducing the resources it has available, such as RAM, virtual memory, disk space, network bandwidth, etc. The crash might require one of those resources reaching a critically low point. By reducing those resources from the beginning, such as by launching a lot of applications, filling up disk space with large files, or starting extremely large file transfers, you can induce the required conditions without the usual wait.

Try examining what you think it is doing around the time of the crash. If it is working on a certain part of a large file, then try making that part of the file into the beginning of the file, either by moving it, or by cutting out everything preceding it. If it is in last stage of a multistage process, then try disabling the prior stages.

Once your crash is easily reproducible, you will need to narrow down the problem. Try taking out easily removable items such as plug-ins and frameworks. Next try commenting out half the suspected code, in a way that leaves the other half still compiling and usable. If the problem persists, then you know the bug is in the uncommented half. Then try commenting out half of that code, and continue with this technique until the bug becomes evident.

Another useful technique is regression, which requires that you use a source control management (SCM) product, such as CVS, Subversion, or Perforce. It will also be useful to have unique version numbers for every build of your product like we discussed earlier. Try going back through previous builds of your product until you find one where the problem did not occur. Then, using your SCM tool, find the changes that were made between the unaffected build and the affected build. Those changes are likely to contain the bug.

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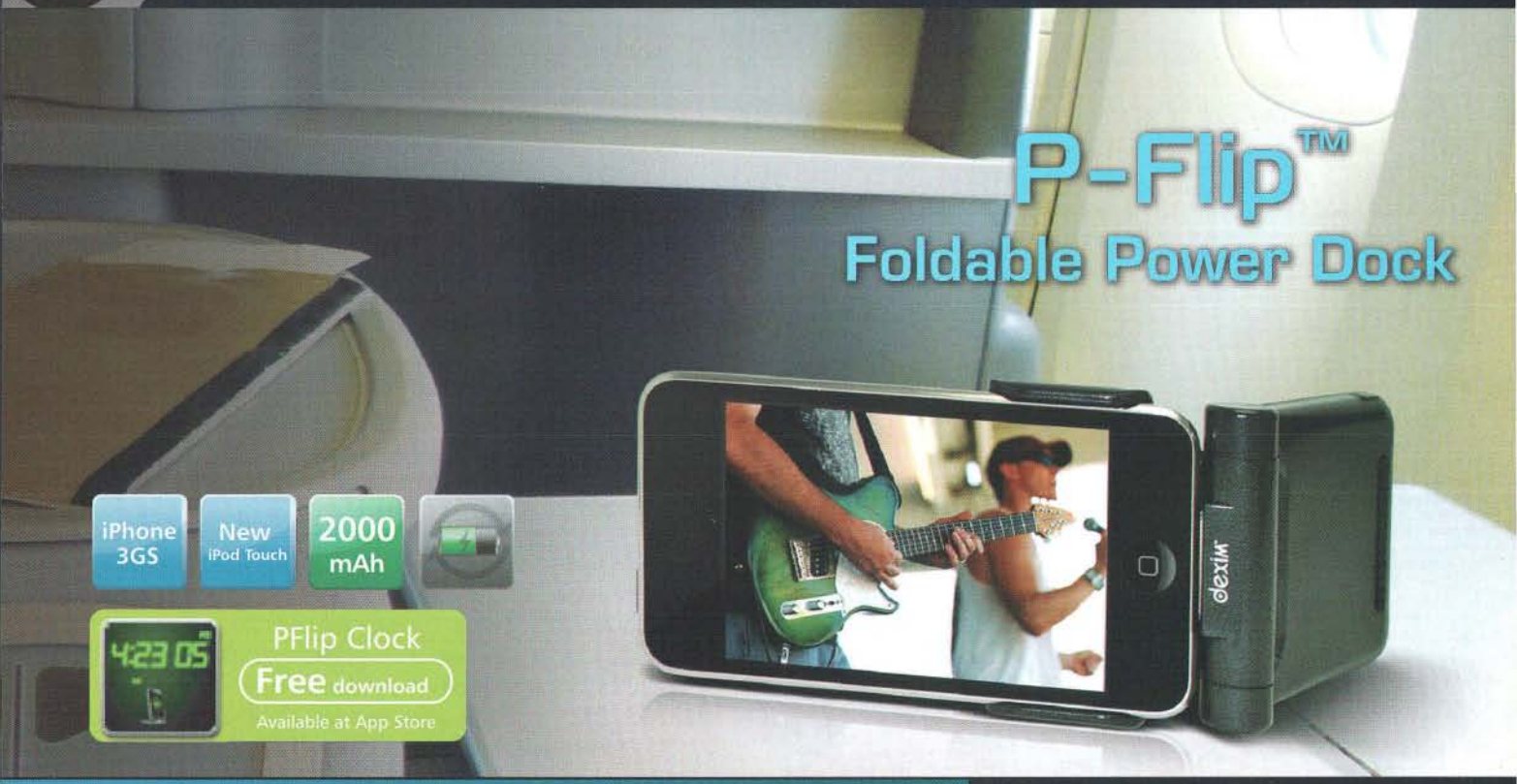

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The Suspect Lineup

You should now be able to turn the problem on or off at will, making the crash occur or not occur.

Now that you have found the fix, you might be thinking that you are done, but there are often many possible fixes for any problem. Do you really want to use whichever one happened to be the first that you found? Take the time to think of a few other possible ways to fix the problem. Then consider the benefits and drawbacks of each. Consider the time it takes to implement, the maintainability of the code, the scope of the changes, and the likelihood that the fix will cause more problems. Now you can pick the best fix and implement it.

The Conviction

You are almost done. Document the bug and the fix in your code, so that neither you, nor the other members of your team inadvertently reintroduce the problem. Document it in your source code management system as well, so that you know when you fixed it, both in regards to time and to versioning. And finally, document it in your release notes so that your users know that this is the update that will fix the problem they are encountering. Do not be so ashamed of the crash that you omit it from the release notes. All applications crash, even Apple's. The fact that you found it, fixed it fast, and made the fix available to your users quickly and honestly, is something to be proud of. Keeping excellent records like this will help prevent the problem from reappearing, and will also provide you with valuable resources for tracking down your next crash.

Suggested Reading

Apple. "Technical Note TN2123: CrashReporter". http://developer.apple.com/technotes/tn2004/tn2123.html

Wikibooks. "X86 Assembly/X86 Architecture". http://en.wikibooks.org/wiki/X86_Assembly/X86_Architecture

William Swanson. "The Art of Picking Intel Registers". http://www.swansontec.com/sregisters.html

About The Author

David Garcea is the Engineering Program Manager for Macintosh Desktop Products at the U.S. headquarters of Telestream, Inc., makers of Flip4Mac WMV, Episode, Drive-in, Pipeline, and ScreenFlow. Drawing on over twelve years of experience making Mac applications and plug-ins, he leads the team of engineers that makes it possible for you to make and watch WMV content on your Mac, load all of your DVDs onto your laptop, or capture, transcode, and edit a multi-camera concert in Times Square. He has a bachelor's degree in computer science from the State University of New York Empire State College, and lives in Northern California. You can reach him at dgarcea@gmail.com.

Keep Track of Where You Are, to Ensure You Get to Where You Need to Be

Part 1 of 2

It is the end of a busy work day. Just as you begin to shut down your computer and get ready for your commute home, your manager stops by your desk. She is wondering if you can provide her with a project update, and put together data from tracking goals, so she can present it to upper management first thing in the morning.

Last minute requests for project updates are not a rare occasion for anyone. Project managers are closer to a project than anyone else on the team. They are expected to know what is going on with everything in a project, at any waking moment. With so many variables associated with a project, it may sometimes seem a daunting task to manage and present accurate assessments on status. If only there was a tool to capture all project data and present it in an impressive format.

ConceptDraw Office contains all of the tools you need to effectively plan, do, and communicate any type of processes or projects you may have. ConceptDraw Office provides you with a strong capabilities to visually communicate important project information using a versatile number of dashboards and mind maps.

In the Gantt chart in Figure 1, tasks that reflect a project in its early stages are depicted as falling behind schedule. From this view it is hard to determine if the project is running behind schedule. It looks like there are some tasks that may be putting the project in jeopardy, yet it is not at the point of failure.

Figure 1: This Gantt chart represents a simple project that is behind its planned schedule.

Visual indicators that illustrate status are a great way to present project data in an easy to understand format. In ConceptDraw Office, these visual indicators are generated by a push of a button in less than one minute. The Project Status Report indicates the overall status of a project.

As you can see in Figure 2, this specific project is not on track with the established plan, but the project is out of the red, critical status. This means there are areas of the project that once improved, can greatly increase the chance of success.

Figure 2: ConceptDraw Office Project Status Visual Dashboard Indicator

This dashboard represents the big picture view of your project. In the dashboard object in Figure 2, you can see the name of the scoreboard object, date generated, name of project, and the overall project status.

All of the reports within ConceptDraw Office are automatically generated with a simple click of a button in less than a minute. The end result is that powerful visual tools can be shared and appreciated by anyone involved with your project. Reports generated in ConceptDraw Office can be exported to many different formats, making it even easier to publish project status details on the web or in a document.

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Alternatives for Exchange

"Exchange for change," or,
"Implementing Exchange Server services without the Exchange Server price."

by William Smith

A gold standard

As much as Mac enthusiasts may like to dog Microsoft, it does have a strong influence in the E-mail and collaboration world. That's not because Microsoft dominates the enterprise market but because its Exchange Server product (http://www.microsoft.com/exchange) is scalable, reliable and feature-rich. A little more than a dozen years old, Exchange Server has morphed from its predecessor Microsoft Mail, which worked over a LAN with clients connecting to file servers, into a suite of tools that not only let co-workers collaborate in the office but extends their offices to the Internet and mobile devices.

Exchange Server was not the first E-mail server. It was not the first to include a calendar, was not the first to offer type-ahead addressing from an address book and was not the first to extend itself through webmail. It has, however, incorporated these features and many more from its kin into a robust system that millions of users today consider fundamental to their work. Today, other collaborative messaging systems—those with features beyond basic mail—compare themselves to Exchange Server in their marketing and advertising. It has become the gold standard.

"We try harder!"

For many reasons, though, Exchange Server isn't for everyone. It runs only on a Windows Server. It requires Microsoft E-mail clients to get the full Exchange experience. It's not simple to administer. It's not cheap.

So, what's the alternative?

In 1962, the Avis car rental company debuted its "We try harder" campaign, which featured a no-nonsense slogan explaining it wasn't the leader in the industry and it knew it. That mentality still hits close to home with many people and its one of the reasons why entrepreneurs still try to compete with Microsoft and why customers will often avoid the big name brand in favor of the "little guy".

A few companies have jumped onto the collaborative messaging bandwagon and directly bill themselves as alternatives to Exchange Server. Two well-known contenders are Kerio and Zimbra, which will be discussed in more detail shortly. Other alternatives are available but Kerio and Zimbra are well established and represent different target markets within the Exchange alternatives group.

A talk about collaborative messaging wouldn't be complete without mentioning both Novell GroupWise and Lotus Notes with Domino server. Both of these products are in direct competition with Microsoft Exchange Server, however, they are existing enterprise solutions with their own footholds of supporters. The purpose of this article is to offer ideas for ways to look at alternatives to Exchange that are targeted toward smaller organizations and those on tight budgets.

What makes Exchange, well, "Exchange"?

Defining "Collaborative Messaging"

Today's current buzzword to describe Exchange is "collaborative messaging". 10 years ago it was "groupware". These are simply terms used to describe the ability to work with others and share information electronically.

At the heart of collaborative messaging is the electronic trinity—*mail*, *calendaring* and *contacts*. These three services go hand-in-hand to help the end-user transfer data, coordinate with others and maintain relationships.

Figure 1. The electronic trinity

see what's next.

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Some might consider a fourth service, Tasks, to be considered fundamental to their workflows for tracking progress. For now, though, only mail, calendaring and address book have standard transfer protocols that allow their data to move between disparate systems. Mail has the MIME format, calendaring has the iCalendar format and the address book has the vCard format. Sending and receiving tasks between server systems is still not commonplace and in many cases simply not possible.

Any fundamental Exchange Server alternative must support these three basic services. Otherwise, it is simply another mail server.

Getting on the same page

Collaborative messaging is more, though, than just these three services running on a server. Collaboration also requires being able to access data in *real time*. For example, users must be able to share their calendars so that others can schedule meetings with them or simply know when they are available. They must also be able to trust that phone numbers updated by a co-worker in the office are correct on their mobile phones.

These three basic services must be available on demand and on a variety of platforms. Mobility and portability are key! A desktop client application such as Microsoft Entourage will offer a rich collaboration experience in the office but is useless when a project manager only has five minutes between meetings in the next building. His mobile device must serve as his client application. When he's vacationing, but still needs the ability to respond to critical messages, a web browser on the hotel kiosk computer can provide yet another avenue for both *accessing* and *contributing* real-time data.

Figure 2. Messaging via web browser, mobile device or desktop client in real time

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Getting Exchange without the Exchange price

Not so fast!

Exchange Server can be expensive to license and maintain. It requires server hardware, a Windows Server operating system license, Exchange Server license, possible other licenses for mobile connectivity and a full- or part-time administrator to turn dials and watch the blinking lights. That doesn't mean, however, that it's out of reach for small companies with small budgets. Exchange is, after all, the gold standard. If it can be had for the price of pennies on the dollar then organizations should look into getting it.

All of Exchange's features work over the Internet just like they would work on a company network. That means someone else can host the server and take care of all the licensing. This setup is known as *hosted Exchange*. Any individual or organization with limited resources can find online deals for hosted Exchange accounts starting at about $35.00 a month for three users.

Hosted solutions can be ideal because the services includes 24/7 technical support, spam filtering and often free client software such as Microsoft Outlook for Windows or Microsoft Entourage for Mac. Be sure that the service provider explicitly offers support for Macs. While most any hosted Exchange solution should work, having someone who can troubleshoot Mac connectivity or performance issues is worth finding. Mobile phone and Blackberry services are usually extra.

Kerio MailServer

Kerio bills its MailServer product as a Microsoft Exchange alternative right under its name on the product website <http://www.kerio.com>. While MailServer may not be feature-for-feature identical to Exchange Server, it comes close to offering both the major and minor features that users familiar with Exchange want.

Kerio has made MailServer to offer a nearly identical end-user experience to that of Exchange Server and it offers its administrators a few features that Exchange Server doesn't have out of the box that would require extra licensing or would be better-suited for a third-party add-on. They include built-in mobile support, built-in spam filtering, built-in antivirus integration (with McAfee antivirus offered for an additional cost), built-in E-mail archiving and a built-in backup system.

Like Exchange, MailServer can be run on servers in-house or is available as a hosted solution from service providers on the Internet. Installation and setup are simple straightforward.

Zimbra Collaboration Suite

"ZCS" is another collaboration suite that is especially popular with Internet Service Providers. It too bills itself as a Microsoft Exchange alternative on its home page and even features a 45-minute "Zimbra vs. Exchange" webinar <http://www.zimbra.com/about/webinar_form.php?showID=10>.

What makes ZCS unique in this round-table of collaboration systems is that its server uses several open source projects that are well known and understood in the open source community. These include Postfix for mail, OpenLDAP for directory services, ClamAV for antivirus protection, SpamAssassin for message filtering and a few others. Unlike Exchange, and MailServer, the ZCS installer interface is presented through a command line interface, which may intimidate novice administrators.

Zimbra offers a free open-source version of its product, licensed under the "Yahoo! Public License (YPL)", as well as a commercial version that includes some non-open source pieces.

Other suites

MailServer and ZCS are just examples of Exchange Server alternatives and should not be considered to be "the best" solutions available. Instead, they represent the idea that Exchange Server alternatives don't necessarily have to operate or behave *just like Exchange* to be viable options. For example, Mac OS X Server with its Mail server, iCal server and Open Directory, could be considered as an alternate messaging collaboration system. A search on the Internet for "Exchange Server alternatives" reveals several more products as well as plenty of side-by-side feature comparison articles.

Under the hood

This is where product differences come to light. Exchange Server alternatives may not reveal themselves as very different when they too can send mail, schedule events and sort contacts, but the engines behind the services can differ like the engines of two cars. One might offer fast performance whereas the other is all about the smooth ride.

Delivery protocols

With Exchange Server 2007, Microsoft introduced a new protocol called Exchange Web Services (EWS), which is the foreseeable future of Exchange. EWS is not like the years-old tried-and-true POP and IMAP protocols and it's certainly nothing like its proprietary predecessor MAPI. Anyone considering something other than Exchange needs to look at this protocol heavily!

Simply put, no other mail server uses EWS. It is Exchange-only. Is that good or is that bad?

Remember, unique features are what drive product differences and EWS is at the core of Exchange Server's offering. This new protocol is based on HTTP, XML and SOAP standards, so the fact that it's proprietary isn't necessarily a drawback. Not only is it extensible, it's very portable and this means it has a bright future going forward. One single protocol has the unique ability to deliver multiple kinds of information (mail, calendaring and contacts, for example)

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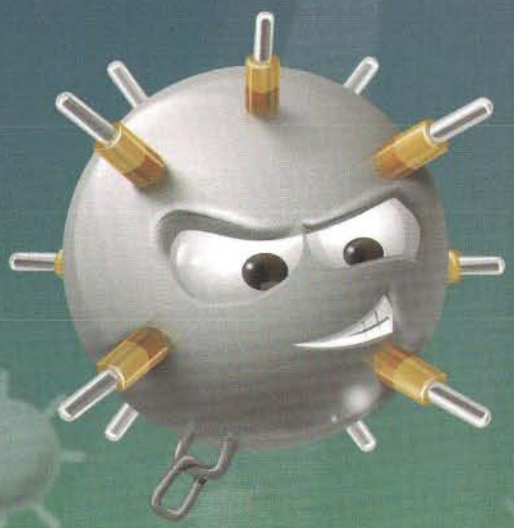

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whereas Exchange alternatives must support three different protocols to deliver the same information.

Because EWS is delivered via HTTP, it has a good probability of surviving proxy servers and other Internet-filtering devices that block most everything but port 80. In corporate environments where VPN is required to access internal resources, EWS can be delivered externally without VPN and it can securely provide the same access to information as if sitting on the company network.

Compare this to MailServer, Zimbra Collaboration Suite and any other collaboration suites. Most everything else will use a combination of different protocols to accomplish the same delivery of information. IMAP will most likely sync mail, CalDAV will most likely provide calendaring services and some form of LDAP will most likely provide directory services. All three of these protocols have years of reliability and stability to their credit and they are based on RFC standards.

The new EWS protocol and the older RFC protocols ultimately accomplish the same thing. They move the data between the server and the user. The trade-off is, again, performance vs. a smooth ride.

Hosting

Where will these collaboration services live and who will support them?

With Microsoft, the choice of operating system for running Exchange Server is made easy: Windows—or rather, Windows *Server*, which is more expensive and more complex to support than its desktop counterpart. Exchange Server 2007 requires a 64-bit platform and all the software and hardware that go with it. It may run on a 64-bit workstation-class machine but it certainly won't run on Windows XP and definitely won't run on Mac OS X Server or Linux without virtualization. Even then, it will require a Windows *Server* license.

Exchange Server alternatives shine here. Because they are based in older and well-established standards, they can take advantage of all the OS porting that has been done in the open source world.

Zimbra Collaboration Suite, for example, runs on Linux servers such as Red Hat, SUSE and Ubuntu and UNIX-based systems like Mac OS X. Kerio MailServer runs on similar systems and goes so far as to support Windows too. MailServer even expands its offerings to non-server operating systems. An old 1GHz Windows XP machine or PowerMac G4

Figure 3. Candidate for a small messaging collaboration server

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with Tiger is a likely candidate for a small messaging collaboration server.

This means that for little investment in hardware and software, any organization can install a complete messaging system and support it on its own. However, that doesn't necessarily mean any organization *should* go into server support. A whiz-kid graphic artist might be able to maintain and troubleshoot a relatively simple setup, but should he really take help desk calls while doing page layout? When a company is big enough to need collaborative messaging but too small to hire an IT guru, then it needs to turn to hosted solutions.

Most every, if not every, collaborative messaging system is offered as a hosted service available via the Internet. Along with hosted Exchange are hosted MailServer and hosted ZCS services and a smattering of service levels that range from individual plans to small- and even medium-size organizations. Microsoft offers its own hosting service at http://www.microsoft.com/online/products.mspx.

Some services, such as Google Apps are offered *only* online, which makes many in-house IT folks uncomfortable. Messaging systems are often mission-critical and when they go down the last thing IT wants to tell its CEO is, "I've called and opened a ticket. They'll get back to us as soon as they can." Viable Exchange alternatives need to be able to offer in-house as well as out-sourced hosted solutions.

Life in the fast lane

Administrators would like a simple and reliable solution to support, however, their job is just to keep the car running for the driver. The end-user *experience* is far more important. Ultimately, systems are put into place to support the needs of those connecting to them.

Client choice

An Exchange solution or any of its alternatives shouldn't dictate which client applications are used.

For a long time, Microsoft ignored this model. Their proprietary mail protocol, MAPI, was complex, closed and undocumented, which prevented competitors from developing their own client solutions. The result was that in order to get full Exchange functionality, customers had to also license the only Exchange-compatible client, Outlook.

Along came Microsoft Entourage for Mac. The Macintosh Business Unit (MacBU) at Microsoft was tasked with taking its existing POP and IMAP client and turning it into an Exchange client as well. At this time, around 2003, WebDAV was growing popular and everyone was jumping on the bandwagon. Exchange Server's Outlook Web Access (OWA) was built on WebDAV and MacBU took advantage of it in the spirit of trying to keep Entourage built on Internet standards rather than proprietary standards.

Literally, if MacBU could develop a mail client using open standards then so could anyone else and that's what Apple did

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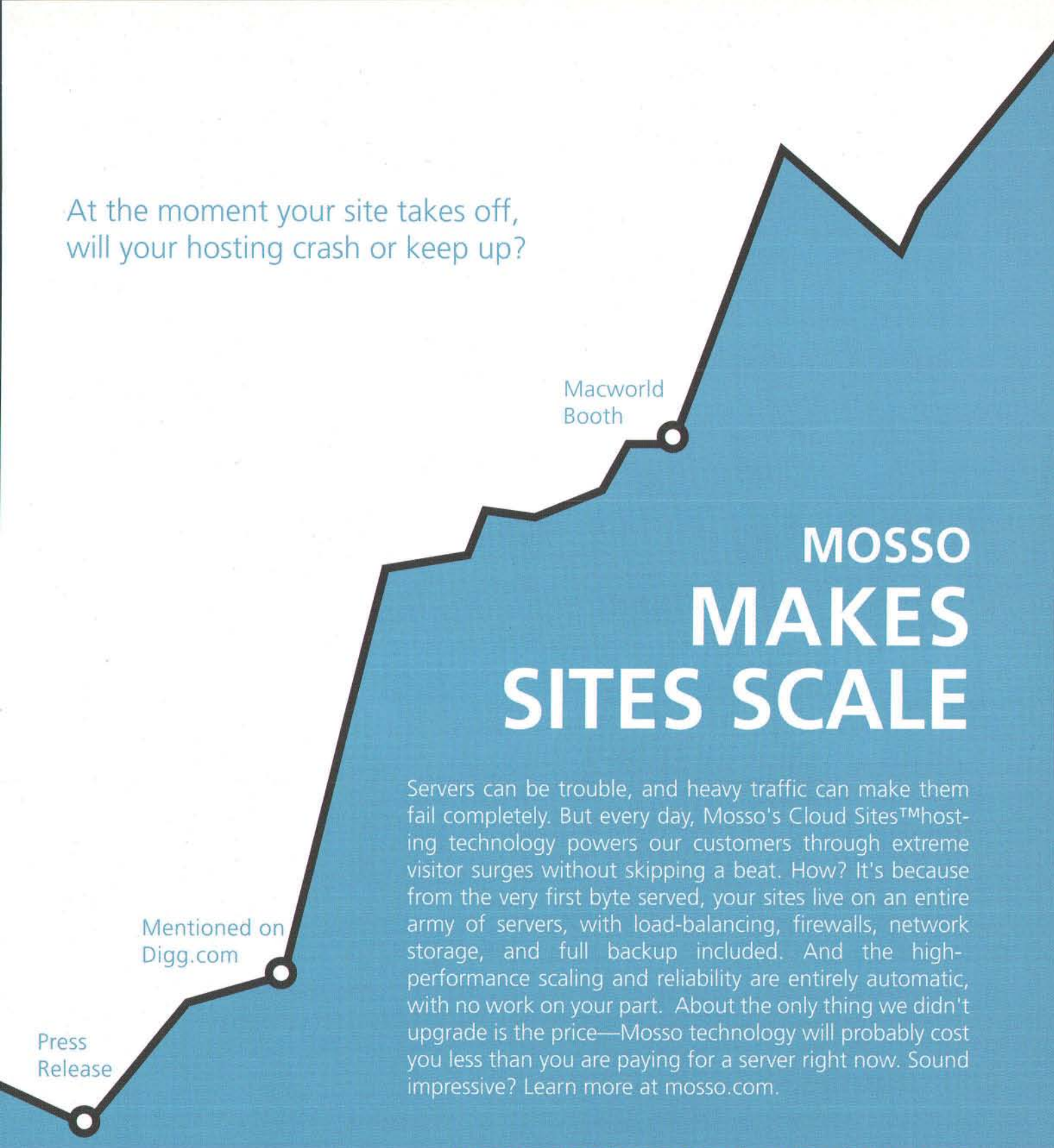

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with Mail 2.0. While it still used IMAP for mail, it did take advantage of WebDAV for calendaring as well as LDAP for directory services and for the first time on a Mac, three non-Microsoft client applications came together to offer basic Exchange-like functionality.

Fast forward three years and Exchange Web Services debuts in Exchange Server 2007. EWS is the result of collaboration between the Exchange Server development team and MacBU to develop an openly documented standard that anyone can utilize. Again, Apple took the lead as the first non-Microsoft company to develop against the new protocol and Mail 4.0 nearly debuted as the first Mac client for EWS. (The folks at MacBU released their Entourage for EWS client just weeks before Mac OS X 10.6 was released.)

The moral of this story is that had Microsoft continued down the path of proprietary and closed systems, it would not have become the gold standard supporting clients on different platforms. Yes, it would probably still have a huge foothold in the corporate Windows world, but someone like Kerio or Zimbra would have been dominating the Mac market. Exchange alternatives should follow this example and open their doors to client applications other than their own.

Webmail

Feature rich clients aren't always accessible or even practical. Exchange Server offers Outlook Web Access (OWA) for account access through a standard web browser as well as ActiveSync for account access on mobile devices.

OWA has made Exchange users on Macs feel like second-class citizens for more than a dozen years. That's because the Exchange Server developers wanted to provide a rich experience through a web browser to their clients. However, they once again used a proprietary Microsoft technology. This technology was ActiveX and although it wasn't limited to just the Windows operating system, no other platforms really adopted it. ActiveX became ipso facto a Windows-only technology. This left all browsers that weren't Internet Explorer for Windows with the OWA "Lite" version and it paled in comparison to what the full version could do.

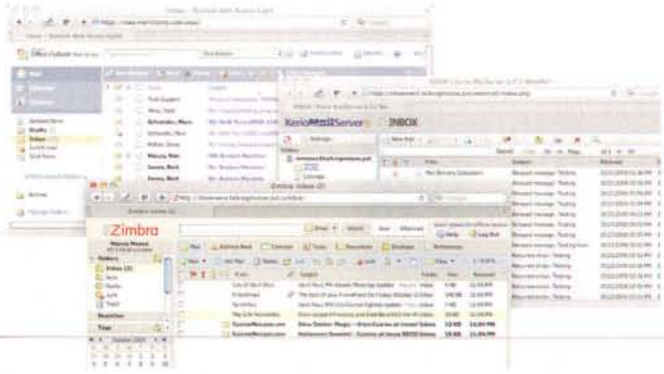


Figure 4. Webmail views from Exchange Server, MailServer and ZCS

Both Kerio and Zimbra have clearly seen this as an opportunity to shine. MailServer and ZCS offer webmail support, as do most modern mail servers. Instead of using ActiveX, however, to offer their rich experience, they employ Ajax, which is built on JavaScript and XML. Again, these are two open and standards-based technologies that anyone can utilize. All popular modern web browsers for both Mac and Windows support Ajax and even Linux browsers can be full webmail citizens.

Most any user connecting to his MailServer or ZCS account can have the experience of dragging and dropping messages into mail folders or right-clicking items and selecting commands from a contextual menu. Columns are resizable and customizable and instead of creating a new *browser* window, Command-N creates a new *mail message* window.

Of note, Exchange Server 2010 will also adopt an Ajax solution or something similar that will allow all web browsers to receive the same feature-rich experience that only Internet Explorer for Windows users enjoy today. Its availability for public consumption has been announced by Microsoft as "second half of 2009", but it was released to manufacturing (RTM) in September, which means it should be available around October or November of 2009. Companies that are early adopters of technology and consumers with hosted Exchange Server accounts will likely be the first to kick the tires and take it for a spin.

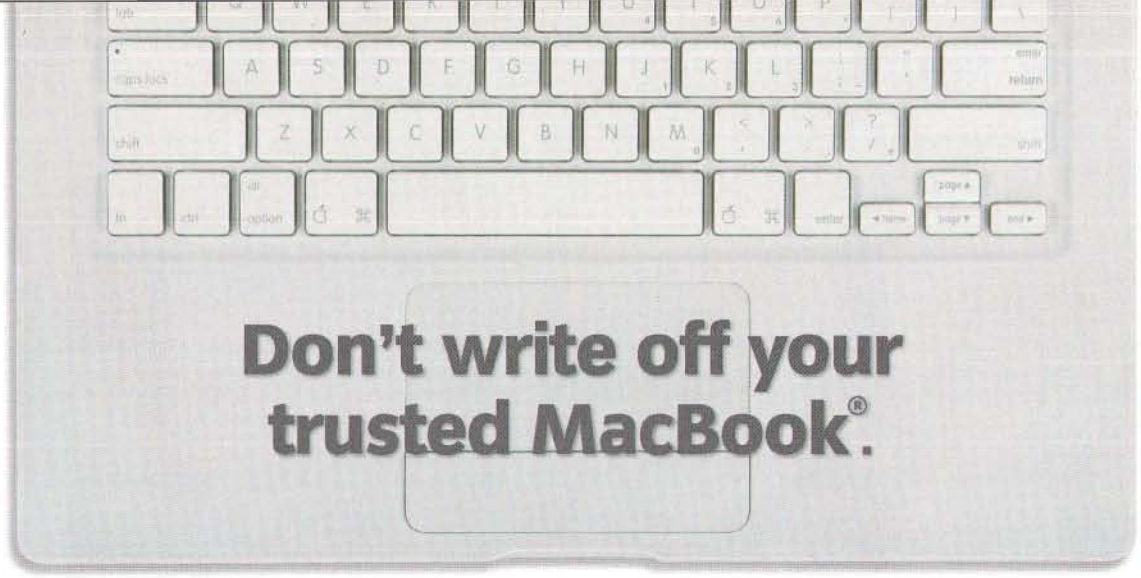
Mobile

The new office is in the pocket or purse. Mobile phones empower people (or enslave them, depending on the point of view) by keeping them tied to their collaborations server 24/7/365. With the popularity of Windows Mobile, Blackberry and the iPhone, the need to be connected all the time has skyrocketed.

However, the technology to keep connected isn't as clean-cut as deciding which protocol works best. Again, Microsoft's influence has the upper hand.

"Push" is the term marketers like to use when describing the mail feature on phones. It has come to mean, "My mail comes to me; I don't have to check it." What's really happening is one of three things. The phone is periodically checking accounts for updates automatically (usually about every 15 minutes), the phone is connecting to an ActiveSync-enabled account that keeps a long HTTP session open and periodically renews it (again, about every 15 minutes) or the phone is a Blackberry and is using a Blackberry mail server to send and receive content.

Standard mail accounts (POP and IMAP) rely on the first method where the phone polls for mail automatically. The downside to this type of connection is that the less frequently that the phone checks for mail, the less the messages are received in real time. The more frequently the phone checks for mail, the greater the battery drain and the less ability to be truly mobile.



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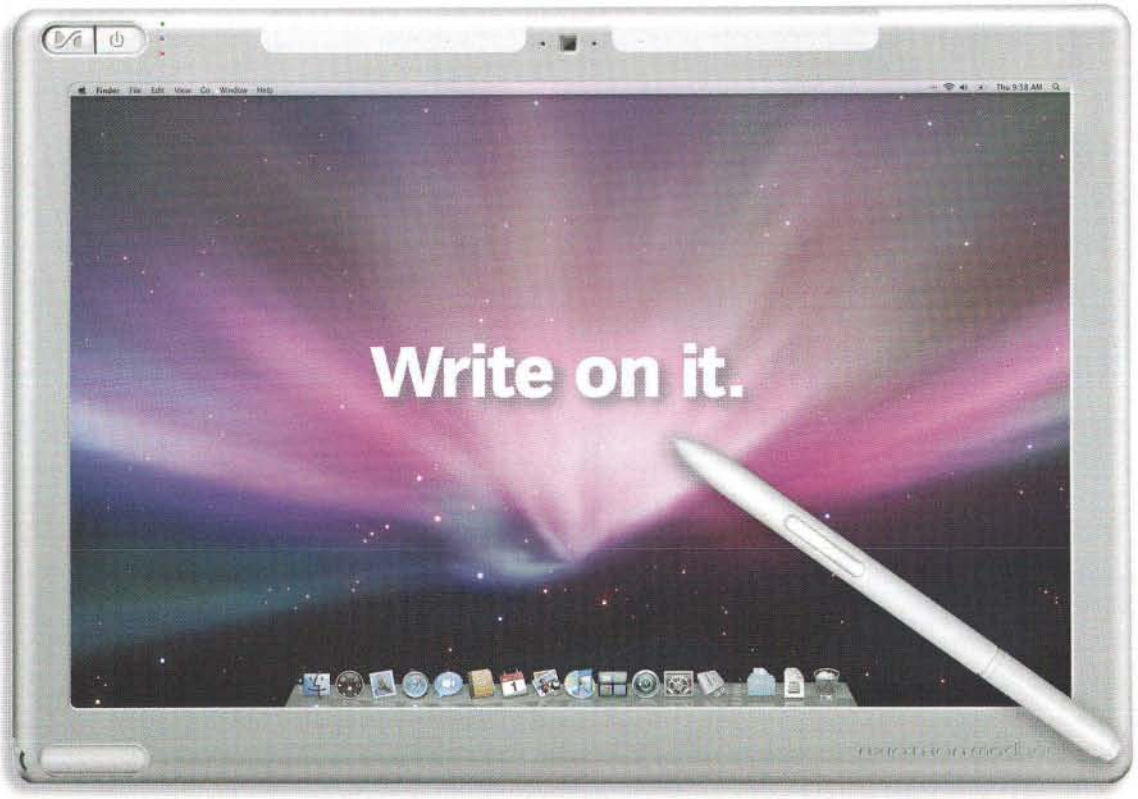

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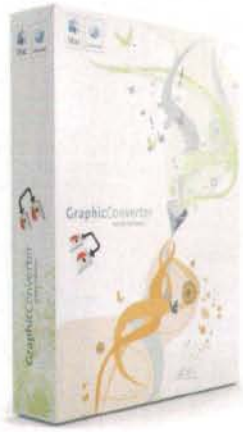

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Figure 5. IMAP accounts will poll about every 15 minutes for new mail

Exchange-type accounts use a Microsoft proprietary protocol call ActiveSync. It works over HTTP by establishing a connection over the Internet to the Exchange Server and then keeping that connection open. Typically, when two devices communicate over a network, they transmit data and then close the session. ActiveSync works by waiting up to about 15 minutes before closing a session and this allows the server to pass a message back to the phone as soon as it is received. If the server doesn't have anything to send within that time period, it closes the session with the mobile device, which then immediately opens a new 15-minute session. The advantage of ActiveSync is less battery drain and messages are received in real time. The downside is that Microsoft owns the protocol and anyone wishing to use it must license it.

Figure 6. ActiveSync is an immediate two-way sync

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Blackberry devices rely on a Blackberry server to be connected to the Exchange Server and then act as an intermediary to forward information back and forth. It too uses HTTP to handle much of its communications and therefore has a lower drain on the battery. The advantage of a Blackberry server is that it can handle more types of information, such as documents, and it can connect to other collaboration systems like Domino and GroupWise. The downside is that this is another proprietary solution that must be licensed and only works with Blackberry devices.

How have the Exchange alternatives decided to handle mobile connectivity? Kerio has licensed ActiveSync from Microsoft, which opens the doors for all Windows Mobile, iPhone and even Blackberry devices running ActiveSync for Blackberry. They will also help integrate a Blackberry system with MailServer for an additional fee. Zimbra has opted to license ActiveSync only for ZCS Network Edition (their commercial product). Remember, Zimbra offers an open source version of their collaboration suite too, but it will have fewer features. Mac OS X Server mobile clients will need to rely on periodic polling to receive their messages.

If mobility is crucial to a company's collaboration system then either an ActiveSync or a Blackberry server solution is required. While IMAP and CalDAV are the common denominators for most every collaboration system on the market, these two protocols have no built-in mechanism for "staying alive". A semi-manual check by the device itself or a protocol made for low-impact syncing will be required.

Luxury vs. Economy

Like any other product, money invested is directly proportional to the features enjoyed, or to put it simply, "You get what you pay for!" Don't take that to mean that Exchange Server is the answer for everyone and that settling for anything else is really just settling for less. Exchange Server obviously isn't for everyone or else everyone would have it and no one would be offering alternative solutions.

Exchange Server is expensive to own and maintain compared to other solutions (after all, it is the gold standard) but its benefits aren't 100% unique. Many of its features are matched by taking advantage of its open technologies, such as EWS, or by licensing its closed technologies, such as ActiveSync. Where an alternative collaboration server solution may not be able to match some of its features, many mimic them by substituting IMAP with scheduled polling for true "push" or by substituting CalDAV calendaring for Exchange calendaring. Depending on the needs of the end-user, one may be just as good as the other.

When owning is not an option then leasing may be the solution. Allowing someone else to assume the licensing, maintenance and support costs for a monthly fee is a great way to "try before you buy" as well as a great way to stay financially flexible in a fluctuating economy. On the other hand, bringing in a low-cost solution and supporting it in-house on inexpensive hardware is appealing to those who need the control over crucial systems.

Most importantly, the end-user should have control over his experience as much as possible. Forcing him to use a certain mail client or mobile device because "that's what the server supports" is like telling him he has to use Windows because "that's what IT supports". The tail shouldn't wag the dog.

In the end, all the end-user knows is that he needs to access his mail, calendar and contacts so that he can effectively collaborate with his co-workers in real time from anywhere using any method available. Chances are that he has no idea what "Exchange" is and doesn't really care what system he is using.

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About The Author

William Smith is a technical analyst and has supported Macs in a Windows world for more than 15 years. He works in the Twin Cities and enjoys educating folks that Macs and Windows really can get along. He's a seven-year Microsoft MVP, co-founder of the Entourage Help Blog http://blog.entourage.mvps.org and will be contributing to the MacIT conference session "Administrating Macs in Exchange 2007 or 2003" at Macworld 2010. You can reach him at bill@talkingmoose.net.

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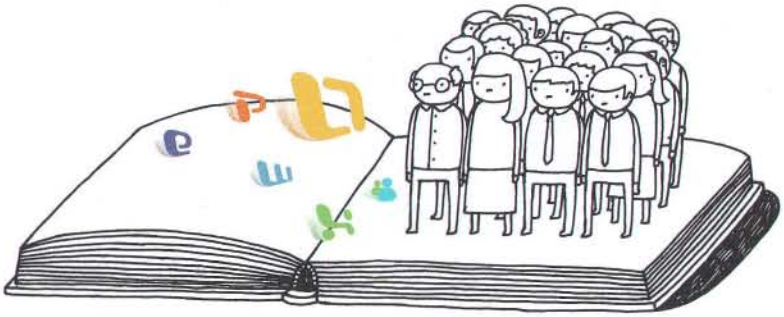

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Needling the Thread

Introduction to threads

Concurrency

Concurrency is probably a buzzword you've heard a lot of recently. As multicore CPUs become more common, concurrency, which allows applications to take advantage of all the CPU power on the user's desk, becomes more important.

Why Concurrency

In a nutshell, concurrency is the ability for applications to perform multiple tasks at the same time. Even with a single core CPU, concurrency can be useful for applications. Often a reason for using concurrency is to utilize all CPU cores for tasks that take are very CPU intensive. However, even if your application is not very CPU intensive, it may still benefit from concurrency. We'll talk about that a bit later in this article.

Multitasking Applications

Multitasking is the ability to do more than one activity at a time. From an operating system's perspective, it is the ability to run more than one application at a time. Many early operating systems, including the classic Mac OS, were only able to run one application at a time. If you were running a word processor and needed to open a diagram in a graphics editor, you had to quit the word processor and then open the graphics editor. They could not both be running at the same time. The running application had the entire CPU for itself.

This was how Mac OS worked until MultiFinder was included in System Software 6, released in 1988. MultiFinder allowed two applications to run simultaneously using a technique called *cooperative multitasking*. Applications had to be specially written for this to work. Each application would go about its business, but if it had a free moment, it would give the CPU back to the operating system. The operating system could then run another application for a bit until that application gave the CPU back to the operating system again.

This was a huge benefit, as users could now run both a word processor and graphics editor at the same time and switch between them without quitting. The disadvantage is that it required applications to voluntarily give the CPU back to the operating system. If a poorly designed application did not do this often enough, or if the running application hangs due to a bug, then the whole system is unusable. This was often a cause of system instability for users of classic Mac OS.

Another limitation of classic Mac OS is that all applications and the operating system ran in the same memory region, also known as *address space*. This means that one application could change the memory of another application or even the operating system itself. This leads to system instability due to program bugs. One application with a bug may cause the whole system crash by corrupting the memory of the operating system.

Cooperative multitasking and lack of memory isolation between applications were probably the biggest limitations of classic Mac OS up through and including OS 9. Enter Mac OS X. OS X, built on a Unix foundation, was trumpeted as the savior from the stability issues of OS 9 by using a better multitasking technique, known as *preemptive multitasking*, and *memory protection* between applications.

Memory protection isolates each application in its own address space. With hardware support from the CPU, it's impossible for one application to write into the address space of another application or the operating system. This is a huge boon for stability, as a bug in one application cannot take down other applications or the entire system.

Preemptive multitasking does away with making applications responsible for giving the CPU back to the operating system. Instead, the operating system has complete control of the CPU and can *take* the CPU away from applications at will. The operating system will switch running applications, many times per second, to give all applications a fair shot of running. Since applications are often idle much of the time, waiting for user input, this provides the illusion of multiple applications running at the same time, even on a single CPU. Even if one application is hogging the CPU, the operating system will force it to give up the CPU occasionally to allow other applications to run.

An application at the operating system level is also called a *process*. In Unix, and hence Mac OS X, a process is a single task that is isolated from other tasks via protection memory, and can be scheduled to run independently of other processes in the system. Mac OS X defines an application as a process that has a GUI. Many processes run on any given Mac OS X system, performing a whole range of system level activities. Run the Activity Monitor application to see all the processes running on your system right now.

What does all this have to do with concurrency? Multitasking operating systems provide concurrency at the process level. Need to do two tasks at the same time? Put them

in separate processes. They will run concurrently, even on a single CPU, as the operating system will share the CPU between them.

Running Processes in Cocoa

You can start a new process in Cocoa using the NSTask class. NSTask is best for running Unix-level processes. Let's say we want to use the standard Unix ls command to get a list of files. This is not a great usage of NSTask as there are better ways to get a list of files, but it's an easy example to understand how processes and NSTask work. The ls Unix command lists files from inside the Terminal application. If you've never used it before, here is what the output would look like:

```
% ls -l ~
Desktop
Documents
Downloads
Library
Movies
Music
Pictures
Public
Sites
```

You pass arguments to the command, in a similar fashion to how you pass arguments to functions in C, except that they are separated by spaces. The first argument is "-1" (dash one), and tells ls to print the output one file per line. The second argument is "~" (tilde), and is the directory to list. A tilde is a shortcut for your home directory. Thus, the output you see is a list of files in your home directory, one per line, which should match what you would see in the Finder.

To use NSTask to run the ls command from a Cocoa application is fairly straightforward. In the simplest use case, it's only a few lines of code:

```
- (IBAction)runTask:(id)sender
{
    NSString * command = @"/bin/ls";
    NSArray * arguments =
        [NSArray arrayWithObjects:@"-1", NSHomeDirectory(),
nil];

    NSTask * task =
        [NSTask launchedTaskWithLaunchPath:command
                                 arguments:arguments];
    [task waitUntilExit];
}
```

You can see this closely mimics what is typed from the command line in Terminal. You do need to give it the full path to the command, and you also use the NSHomeDirectory() function in place of the tilde, but the end result is the same.

By default, the output of a process run with NSTask goes to the console of the application that launched it. If you hooked up this action to a button and pressed it, the output would show up in your console.

The downside with this simple use of NSTask is that we can't use the output in our application. What we want to do is capture the output so we can use it, instead of allowing it to get sent to our console. Unix allows two processes to communicate with each other via a *pipe*. A pipe is a one-way byte stream. We can setup a pipe going from ls to our process, and then read the output from the pipe. Using the output, we can get the list of files into an NSArray. Here's the full code, and we'll step through it piece by piece:

```
- (IBAction)runTask:(id)sender
{
    NSString * command = @"/bin/ls";
    NSArray * arguments =
        [NSArray arrayWithObjects:@"-1", NSHomeDirectory(),
nil];

    // Create the task and setup its arguments
    NSTask * task = [[NSTask alloc] init];
    [task autorelease];
    [task setLaunchPath:command];
    [task setArguments:arguments];

    // Create pipe and hook it up to the process
    NSPipe * outputPipe = [NSPipe pipe];
    [task setStandardOutput:outputPipe];

    // Start the process
    [task launch];

    // Retrieve all the output data from the pipe
    NSFileHandle * outputHandle =
        [outputPipe fileHandleForReading];
    NSData * outputData =
        [outputHandle readDataToEndOfFile];

    // Convert it to a string
    NSString * outputString =
        [[NSString alloc] initWithData:outputData

encoding:NSUTF8StringEncoding];
    [outputString autorelease];

    // Split the lines into an array of strings
    NSCharacterSet * newlines =
        [NSCharacterSet newlineCharacterSet];
    NSArray * files =
        [outputString
componentsSeparatedByCharactersInSet:newlines];

    // We've now got an array of file names
    NSLog(@"Files: %@", files);

}
```

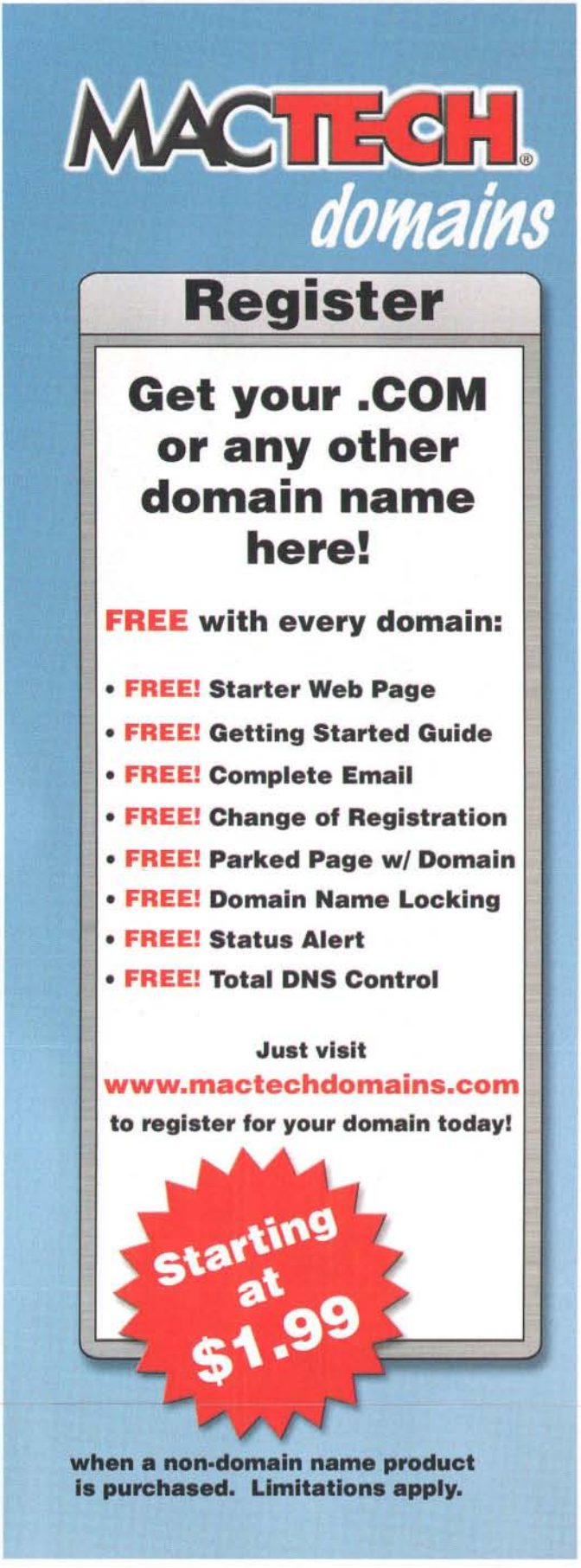
This starts off similar, but we need to create the NSTask using its designated initializer, init, and set the launch path and the arguments using the setters.

Now comes the tricky part. We create the pipe that we are going to connect between our process and ls. There are two sides to a pipe: one side for writing and one side for reading. The ls process is going to use the writing side, and we're going to use the reading side. So, first we create the pipe, and tell ls to use it for output:

```
    // Create pipe and hook it up to the process
    NSPipe * outputPipe = [NSPipe pipe];
    [task setStandardOutput:outputPipe];
```

This has to be done before the process is started. Once it is running, we read all data from the read end of the pipe until the ls process is finished:

```
    // Retrieve all the output data from the pipe
    NSFileHandle * outputHandle =
        [outputPipe fileHandleForReading];
```




```
    NSData * outputData =
        [outputHandle readDataToEndOfFile];
```

At this point, the `ls` process has run to completion, and we no longer need to use the `NSTask`. From here on out, we're just processing the data. Since we know that `ls` outputs a string, we convert the data into one big string:

```
    // Convert it to a string
    NSString * outputString =
        [[NSString alloc] initWithData:outputData

encoding:NSUTF8StringEncoding];
    [outputString autorelease];
```

This string contains the whole, multi-line output as one big string. We want a string per file name. `NSString` has a method we can use to split the string into an array of strings at every newline:

```
    // Split the lines into an array of strings
    NSCharacterSet * newlines =
        [NSCharacterSet newlineCharacterSet];
    NSArray * files =
        [outputString
componentsSeparatedByCharactersInSet:newlines];
```

At this point, we finally have an array of files from the directory. Again, there are much better ways to get a list of files in a directory, but this shows us how to use a separate process to achieve the results. The `NSFileHandle` class even has a method, to read output asynchronously, aptly named `readInBackgroundAndNotify`, so we don't have to wait for it. We can go about our business, and it'll send us a notification with the data after the process exits.

Threads

Multiple processes work well for tasks that are fairly unrelated, but not so well when the tasks are closely related. As you can see above, shuffling data between processes is kind of a pain in the neck. There are other methods of interprocess communication, or IPC, such as sockets, shared memory, and signals, but they are also a bit of a pain to use. Sometimes you *want* to be able to run multiple tasks in the same address space.

While this may sound like going back to the dark days of classic Mac OS, with its lack of memory protection, nearly every modern operating system that provides memory protection allows a process to create multiple tasks inside a single process called *threads*. All threads of a process share the memory of the process; however, each thread has its own set of local variables and stack. Each thread is also scheduled independently of each other by the operating system using preemptive multitasking. It's like running multiple applications that share all their memory.

So given that operating systems and CPUs go through a lot of effort to keep processes isolated from each other, why would you want to use threads? The main reasons are to keep the user interface responsive and to utilize multiple processors and cores.

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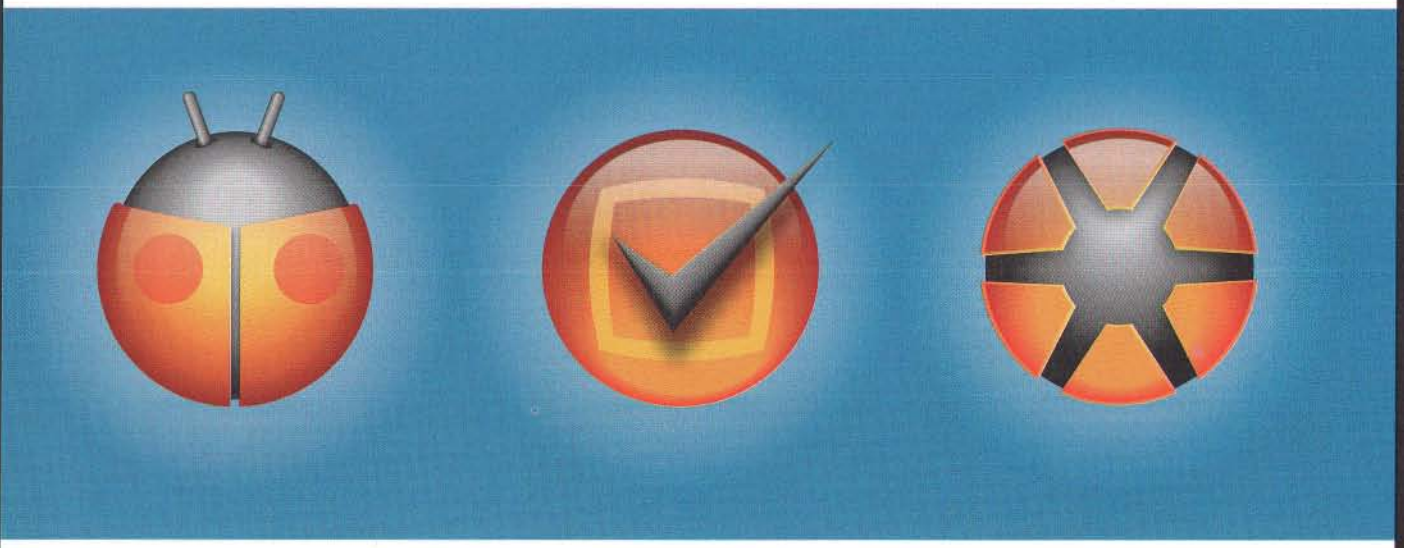

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Threads and Multiprocessor Systems

Not long ago, all personal computers contained a single CPU, and each CPU could only run a single task. For those a bit more familiar with CPU architecture, the CPU only had one program counter (PC) and could only execute one thing at a time. These kinds of CPUs are called *single core* CPUs. CPUs like the 68k series, PowerPC CPUs like the G3 and G4, and Intel CPUs like the Pentium are all single core CPUs.

In order for a computer to provide more CPU horsepower, it is possible to put more than one CPU inside a single computer that shared the same memory. Generally, these kinds of computer systems, where each CPU is treated equally, are called *symmetric multiprocessor* systems or SMP systems. SMP systems used to be far more common for server machines, but some desktop workstations such as the Power Mac G5 and the Mac Pro are SMP systems that contain multiple CPUs.

In more recent times, as CPU manufacturers have found it increasingly difficult to increase clock speeds, they are putting multiple CPU cores into a single CPU. This means you are getting SMP-like power out of a single CPU. Such CPUs are called *multicore* CPUs and Intel CPUs such as the Core Duo and the Core 2 Duo are all multicore CPUs with two CPU cores. Newer Intel CPUs such as the Core i5 and Core i7 can even have *four* CPU cores in one CPU. Apple has been shipping multicore CPUs with all its consumer products for about three years now; pretty much since the Intel transition.

It's worth noting that from a programming a perspective, mulitcore CPUs and SMP systems look almost identical. An SMP system with four single core CPUs looks and acts almost identical to one multicore CPU with four cores. A CPU core is equivalent to a whole CPU, from a processing perspective.

This means that nearly every Mac user's desktop has multiple CPUs available for programs to utilize. The operating system itself can take full advantage of these cores and can schedule separate processes on each core. Thus while one core may be chugging away encoding video for a DVD, you can still read email and browse the web on the other core with out any slowdown.

Some applications may want to use those extra CPU cores for their own use, though. Perhaps that DVD encoding could complete four times faster if the application was able to use four CPUs to encode in parallel. In order to do this, the application would need to split the DVD encoding on to four separate threads. Each thread could then run on its own CPU core independently. Any application where the limiting factor is the amount of CPU it can utilize, called *CPU bound* applications, can use threads to exploit the multiple CPUs available.

Threads and User Interface Responsiveness

Another example where threads are useful is to keep the user interface responsive. AppKit, the GUI framework for Cocoa

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applications is inherently single threaded. All user events are handled on one thread, called the *main thread*. And user events are handled synchronously, meaning that each event is handled to completion, before the next event is handled. All action events, such as button presses and menu clicks, are handled this way on the main thread.

This has some consequences, though. If the response to a button press is to perform a long running task, it stops the whole user interface from running. If this happens for a prolonged period of time, the user gets the dreaded spinning wait cursor, as shown in Figure 1. The spinning wait cursor is unofficially named the "spinning pinwheel of death" or the "spinning pizza of death," shortened to SPOD, depending on who you ask. When an application SPODs, the user can't interact with it all. No mouse clicks are registered, and the user interface appears frozen.

Figure 1: The spinning wait cursor, a.k.a. SPOD

This isn't good at all, but one way to cure this is to execute the long running task in a background thread. This frees up the main thread to handle the user interface, while the background thread chugs along on long running task in parallel. As a bonus, on multicore CPUs, the main thread and background thread can run independently, which may allow the task to complete faster than if both had to share the same CPU.

Simple Thread Example

Let's go through an example of how you would use threads to offload a long running task to a background thread. Say you have an action that takes a long time to complete:

```
- (IBAction)runLongTaskWithoutThreads:(id)sender
{
    NSLog(@"Starting task");
    [NSThread sleepForTimeInterval:10.0];
    NSLog(@"Task finished");
}
```

That sleep method call causes the current thread to stop running for 10 seconds. It doesn't really do anything, and I'm just using that to simulate a task that takes 10 seconds to run. If you hook this up to a button and click it, it'll cause your application to SPOD until the task completes.

Creating a thread to perform this task is quite simple. The `NSThread` class has a class method for creating a new thread:

```
- (IBAction)runLongTaskWithThreads:(id)sender
{
    [NSThread
detachNewThreadSelector:@selector(longRunningTask)
                                    toTarget:self
                                  withObject:nil];
}

- (void)longRunningTask
{
    NSAutoreleasePool * pool = [[NSAutoreleasePool alloc]
init];
    NSLog(@"Starting task");
    [NSThread sleepForTimeInterval:10.0];
    NSLog(@"Task finished");
    [pool drain];
}
```

The `detachNewThreadSelector:...` method creates a new thread that begins execution on the given selector and target, in this case the `longRunningTask` method of our own class. We place our long running task in this method instead of the action method, so the action method doesn't have to wait for it to finish.

You'll notice that we also needed to set up an autorelease pool. Each thread *must* have its own autorelease pool. When we were creating a command line tool, we had to create an autorelease pool, too. When writing GUI applications, AppKit takes care of the autorelease pool for the main thread, but if you create your own threads, you need to create one yourself. Also, keep in mind that this is only relevant for non-garbage collected applications. If you're using garbage collection, you do not need to set up an autorelease pool.

Dangers of Threads

You'll notice that creating and using threads in Cocoa is surprisingly easy. However, threads are not a panacea. In fact, using threads is an extremely sharp double-edge sword. Writing applications that work properly with threads can be a very difficult task.

One of the largest dangers of writing multithreaded code is writing code that is not *thread safe*. One of the benefits of threads is the ability to share data between threads. But data shared between threads must be shared in a thread safe manner. Failure to do so can result in hard to debug bugs.

As a simple example, take a look at the code in Listing 1. It's a simple class that generates a sequence of integers. The sequence starts at zero, and every time the `next` method is called, it returns the next number in the sequence.

Listing 1: UnsafeSequence.m

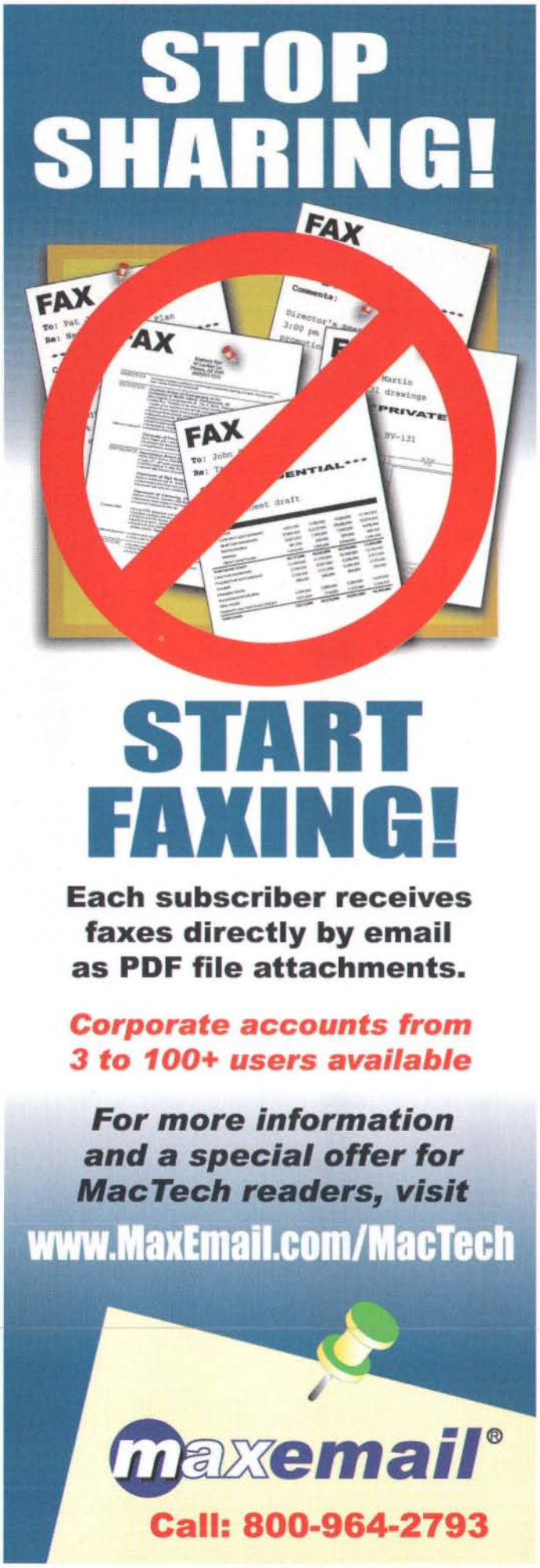
```
#import "UnsafeSequence.h"

@implementation UnsafeSequence

- (id)init
{
    self = [super init];
    if (self == nil)
        return nil;

    _value = 0;
    return self;
}

- (int)next
{
```




```
    return _value++;
}

@end
```

To demonstrate how to use this, let's call this sequence from a loop:

```
    UnsafeSequence * sequence = [[UnsafeSequence alloc]
init];
    for (int i = 0; i < 5; i++) {
        NSLog(@"sequence: %d", [sequence next]);
    }
    [sequence release];
```

The output would look like this:

```
sequence: 0
sequence: 1
sequence: 2
sequence: 3
sequence: 4
```

This code looks simple enough, and it works just fine in a single-threaded application. The problem comes into play when two threads both try and call next on the same `UnsafeSequence` instance. This class is not thread safe.

Remember that Mac OS X is a preemptive multitasking operating system. Preemptive multitasking means that the operating system can, at any time, switch which thread is currently running. If this happens at *just* the right time, then it'll interfere with our sequence.

To make the problem more obvious, let's deconstruct the next method. It's currently one statement, but that one statement is actually doing multiple things:

```
- (int)next
{
    return _value++;
}
```

The `next` method could equivalently be written as:

```
- (int)next
{
    int result = _value;
    _value = result + 1;
    return result;
}
```

In the single line variant, the compiler is essentially expanding out to this code for us. In the expanded version, the operating system can preempt a thread between any of the statements. If the operating system happens to switch threads in one thread after result is assigned, you could have a timeline as in Figure 2.

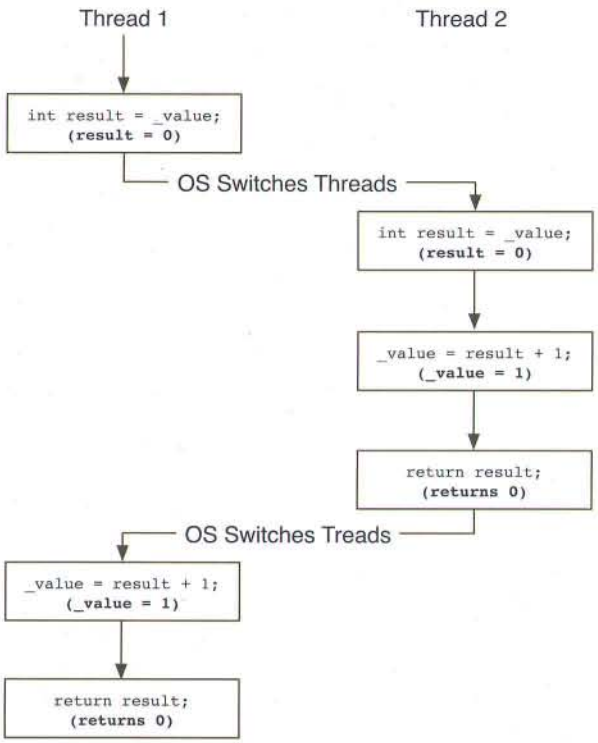


Figure 2: Unlucky thread switch

What happens in this case is that two threads are trying to use and modify the `_value` instance variable. In other words, `_value` being shared between multiple threads. The problem is that both threads return 0 from `next`, and `_value` is set to 1, even though `next` has been called twice. All of a sudden our sequence isn't much of a sequence.

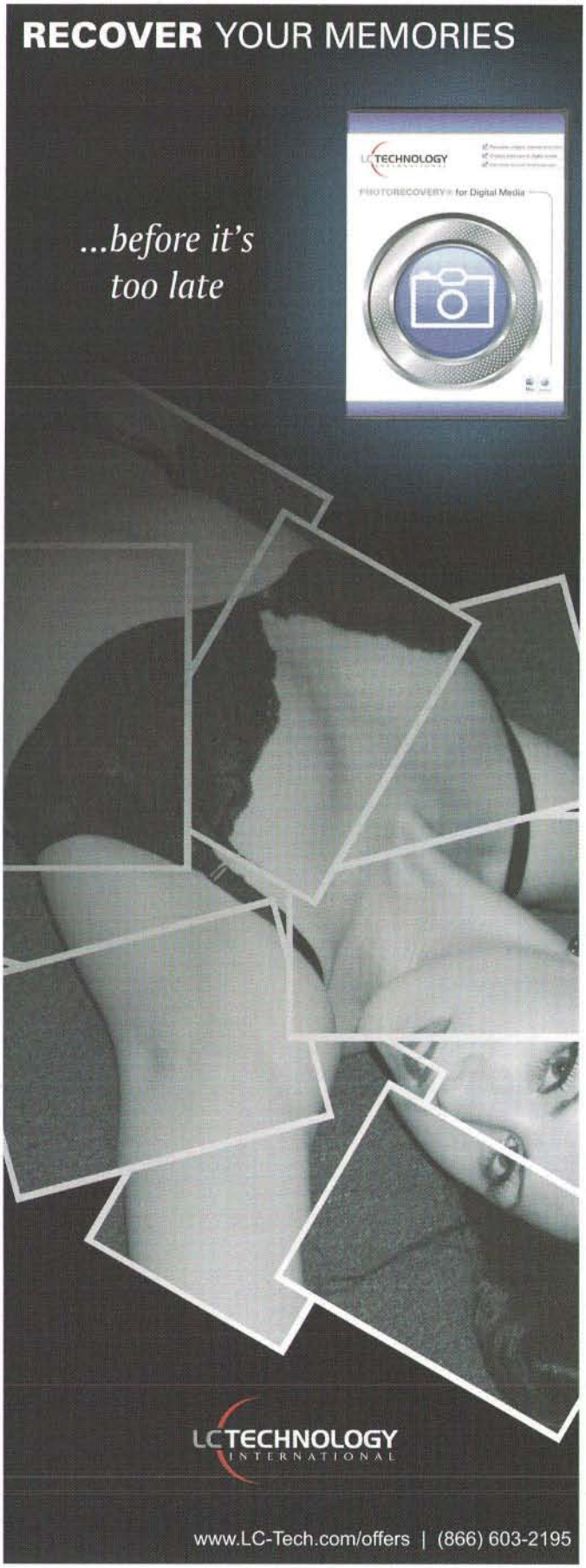
We only see this problem if the operating system happens to switch threads at a particularly unlucky time. If it doesn't switch between the getting and setting of `_value`, then everything is okay. This kind of problem, where code works fine most of the time, but fails only for some unlucky thread switch situation, is called a *race condition*. Race conditions are particularly hard to find and debug because your program may use a class that is not thread safe, like `UnsafeSequence`, from multiple threads for a long time before you ever actually see this situation. Race conditions are often not repeatable, meaning you could get customers reporting problems that you can't reproduce and debug yourself. This makes for unhappy customers *and* developers.

The root of this race condition is that the operating system can preempt the thread between these two operations:

```
int result = _value;
_value = result + 1;
```

Because of the operating system can preempt between these operations, this series of operations is called *nonatomic*. The fix is to turn these series of operations into one indivisible operation where the operating system won't preempt us.

You can do this using what's known as a *lock*. Simple locks can be invoked using the `@synchronized` keyword:



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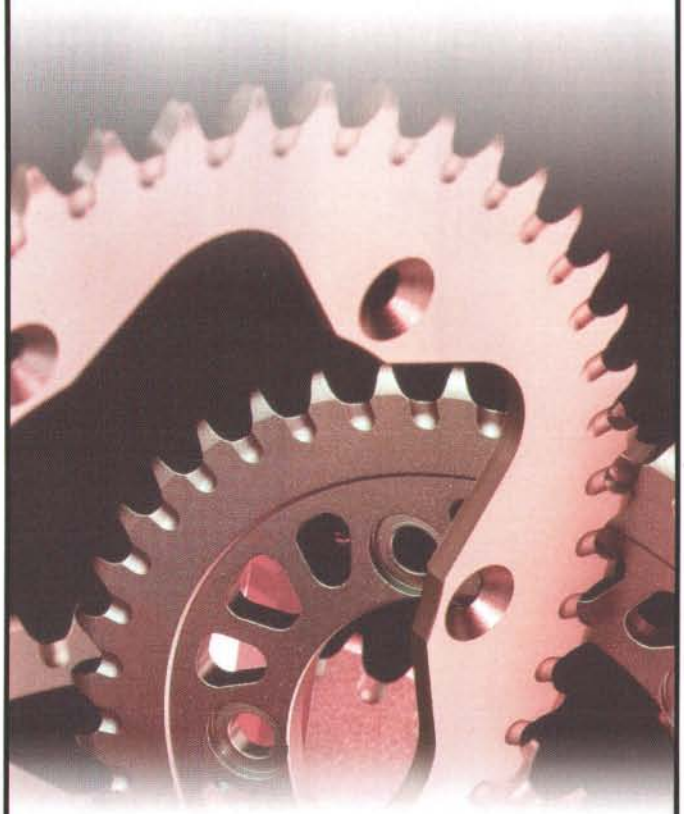

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```
- (int)next
{
    int result;
    @synchronized(self) {
        result = _value;
        _value = result + 1;
    }
    return result;
}
```

By wrapping the critical section in a `@synchronized` block, we are making those operations *atomic*. The operating system will no longer preempt between those two operations and we've eliminated the race condition.

While locks do solve the problem in this case, they, have their own set of issues. Improper use of locks can result in problems called *deadlocks* and *live locks*. Unfortunately, we don't have the time to discuss these topics in this article. However, whole books have been written on the topic. One book that I highly recommend is called *Java Concurrency in Practice* by Brian Goetz. Even though the book is written for Java, many of the principles are universal to writing multithreaded code in any language.

Because writing safe multithreaded code is so difficult and hard to debug, the first rule of writing multithreaded code is don't do it. If you write only single-threaded code, then you won't have any thread safety issues such as race conditions. If you find you really do need to use multiple threads, proceed with caution.

I know I gave an example of downloading data from the Internet as one use for threads, but Foundation actually provides methods to do this without using threads. The `NSURLConnection` class provides asynchronous methods so that the operating system will download the data in the background for you and notify you when data is available. I highly encourage you to use existing asynchronous APIs where possible and avoid threads.

Another danger of threads with Cocoa applications is that AppKit is almost entirely *not* thread safe. This means that AppKit view and controller classes can only be accessed from the main thread. Thus, if a background thread is generating or collecting data that needs to be displayed in the UI, you can't just access the UI from the background thread.

When you do need concurrency, Mac OS X provides some alternatives to using threads and locks directly, including sending messages between threads, the `NSOperationQueue` introduced in 10.5 and Grand Central Dispatch, introduced in 10.6. We'll cover these topics in future articles. In the mean time, you should begin to explore multithreading on your own.

About The Author

Dave Dribin has been writing professional software for over eleven years. After five years programming embedded C in the telecom industry and a brief stint riding the Internet bubble, he decided to venture out on his own. Since 2001, he has been providing independent consulting services, and in 2006, he founded Bit Maki, Inc. Find out more at <http://www.bitmaki.com/> and <http://www.dribin.org/dave/>.

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Main web site: www.mactech.com

Get your .COM or any other domain name here! Get a new domain name, transfer or renewal for as little as $1.99* with each and every new, non-domain product you buy — no quantity limit! Every domain includes Complete Email ($9.99/yr value!) and much more!

See advertisement on page 62 of this issue.

MacTech Magazine

PO Box 5200
Westlake Village, CA 91359
Sales: 877-622-8324
Main web site: www.mactech.com

The MacTech CD - Volumes 1.01-23.06 is packed with more than ever before — over 2900 articles from more than 260 issues (1984 - June 2007), all 29 issues of Apple's develop, 21 issues of FrameWorks magazine, all the source code, MacTech Viewer, working applications, full documentation, demos for techs, and more!

See advertisements on pages 31 and 78 of this issue.

Microsoft

One Microsoft Way
Redmond, WA 98075
Sales: 800-MICROSOFT (642-7676)
Main web site: www.microsoft.com

Office 2008 for Mac: You'll build great looking documents in no time. Achieve more and simplify your workday. Enjoy productivity as you unleash your creative side with powerful, easy-to-use, intuitive tools.

See advertisement on page 59 of this issue.

/n software inc.

1415 Hwy 54 West, Suite 209
Durham, NC 27713
Sales: 919.544.7070
Main web site: www.nsoftware.com

A leading provider of cross-platform software components for communication, security, and e-business development

See advertisement on the inside front cover of this issue.

Now Software

670 Morrison Road, Suite 220
Gahanna, OH 43230-5324
Sales: 800-344-9160
Main web site: www.nowsoftware.com

Based in Columbus, Ohio, Now Software is the developer of the Eddy award-winning Now Up-to-Date & Contact. Now Up-to-Date & Contact is the #1 Calendar and Contact Management software for business and power users! Cross platform group meeting scheduling for both Macintosh and Windows.

See advertisement on page 35 of this issue.

OlympicControls Corp.

1250 Crispin Drive
Elgin, IL 60123
Sales: 847-742-3566
Main web site: www.occorp.com

BookEndz specializes in providing Apple customers with products that will enhance their experience with Apple Laptop Computers. Our goal is to provide quality Docking Stations and other accessory products as quickly as possible after Apple introduces new and updated laptop computers.

See advertisement on page 57 of this issue.

On-Target Reports, Inc.

10800 Alpharetta Highway, Suite 208-601
Roswell, GA 30076
Sales: 404-452-9652
Main web site:
www.OnTargetReports.com

On-Target Reports can help you generate dynamic reports quickly and easily.

See advertisement on page 30 of this issue.

Paradigma Software

6107 SW Murray Blvd.
#151
Beaverton, OR 97008
Sales: (503) 574-2776
Main web site: www.paradigmasoft.com

Ultra-fast database server

See advertisement on page 30 of this issue.

Parallels Inc.

500 SW 39th St., Ste 200
Renton, WA 98057
Sales: 425-282-6400
Main web site: www.parallels.com

Parallels Desktop for Mac is the award-winning desktop virtualization software that currently enables more than 2 million Mac users to run Windows, Linux and other operating systems side-by-side with Mac OS X on any Intel-powered Mac — without rebooting!

See advertisement on page 2-3 of this issue.

Pearson Education Communications

800 E. 96th St.
Indianapolis, IN 46240
Sales: 201-236-7000
Main web site: www.pearsoned.com

Our unparalleled businesses and brands include Prentice Hall, Longman, Scott Foresman, Addison Wesley, Allyn & Bacon, Benjamin Cummings, PASeries, ELLis, Celebration Press, PEMSolutions, SuccessMaker, Waterford, and Family Education Network. Pearson's other primary operations include the Financial Times Group and the Penguin Group.

See advertisement on page 9 of this issue.

Powerbookmedic.com

500 Wynn Drive, Suite 510
Huntsville, AL 35816
Sales: 866-726-3342
Main web site:
www.powerbookmedic.com

Powerbook Medic is the ultimate in Macbook, iBook, and Powerbook Parts & Repairs

See advertisement on page 37 of this issue.

PrintDirectforLess.com, Inc.

27500 Royalton Road
P.O. Box 669
Columbia Station, OH 44028
Sales: 800-301-8870
Main web site:
www.printdirectforless.com

PrintDirectforLess.com offers a wide variety of custom, wholesale, online printing services.

See advertisement on page 15 of this issue.

Rackspace Cloud

9725 Datapoint Drive, Suite 100
San Antonio, TX 78229
Sales: 877.934.0409
Main web site:
www.rackspacecloud.com

Mosso is a company where everything is fast: you'll get started in minutes, scale up before your traffic does, and get expert support in about two phone rings. Cloud hosting? That means you don't fight with any hardware - ever - because advanced technology provides you with room (and power) to spare. Isn't that how hosting should be?

See advertisement on page 53 of this issue.

REAL Software, Inc.

PO BOX 162181
Austin, TX 78716
Sales: 512-328-7325
Main web site: www.realsoftware.com

Use REALbasic to create software for Windows, Macintosh and Linux from a single set of source code! It's cross-platform development that really works!

See advertisement on page 69 of this issue.

RichardSolo

336 Bon Air Center #435
Greenbrae, CA 94904
Sales: 1-415-461-4374
Main web site: www.richardsolo.com

RichardSolo is an online store that puts customer service and satisfaction as a first priority.

See advertisement on page 23 of this issue.

Seapine Software, Inc.

5412 Courseview Dr., Suite 200
Mason, OH 45040
Sales: 513-754-1655; 888-683-6456
Main web site: www.seapine.com

Designed for the most demanding software development environments, Seapine's Mac OS X-native application lifecycle management (ALM) solutions are scalable, feature-rich, team-based tools that can be used separately for superior issue tracking, test case management, and software configuration management—or seamlessly integrated for more efficient control of your software development process.

See advertisement on page 63 of this issue.

Small Dog Electronics

1673 Main Street
Waitsfield, VT 05673
Sales: 800-511-MACS
Main web site: www.smalldog.com

Small Dog Electronics is an Apple Specialist, one of the larger Apple resellers in the US. We specialize in all things Macintosh, including Apple refurbished products.

See advertisement on the inside back cover of this issue.

Small Tree Communications

7300 Hudson Boulevard, Suite 165
Oakdale, MN 55128
Sales: 866-STC-4MAC
Main web site: www.small-tree.com

Small Tree designs simple-to-install, inexpensive Mac-based networking and shared storage products for creative and other industries where data speed, security and efficiency are critical.

See advertisement on page 42 of this issue.

SmileOnMyMac, LLC

PMB 278
350 Bay St, Suite 100
San Francisco, CA 94133
Main web site: www.smileonmymac.com

Creative software on your Mac that does what you want.

See advertisement on page 19 of this issue.

Smith Micro Software, Inc.

185 Westridge Drive
Watsonville, CA 95076
Sales: 888-245-1723
Main web site: www.allume.com/

Smith Micro Software's Consumer Division (formally Aladdin Software, Allume Systems) develops and publishes award-winning software solutions in information access, compression, recovery, security, and removal for Windows and Macintosh. Our leading brands are StuffIt®, Internet Cleanup™ and Spring Cleaning®. Symbol SMSI. Contact Smith Micro's Consumer Division at (831) 761-6200 or visit www.allume.com

See advertisement on page 39 of this issue.

SuperSync

6114 La Salle Ave #712
Oakland, CA 94611
Main web site: www.supersync.com

SuperSync is the best way to visually compare and merge multiple iTunes libraries. All your music, movies, and playlists can be synced across all the computers you keep music on.

See advertisement on page 26 of this issue.

TechSmith Corporation

2405 Woodlake Drive
Okemos, MI 48864-5910
Sales: 1.517.381.2300
Main web site: www.techsmith.com

We create screen capture and recording software to help you communicate clearly and effectively, deliver engaging presentations, analyze usability and conduct market research. For over 20 years, we've helped people communicate visually and look great doing it.

See advertisement on page 51 of this issue.

Telestream

848 Gold Flat Road, Suite 1
Nevada City, CA 95959
Sales: 530-470-1300
Main web site: www.telestream.net

Capture the contents of your entire desktop at the same time as your video camera, microphone and computer's audio. Sophisticated editing tools allow you to create incredible screencasts in no time. The finished result is a QuickTime movie, ready for publishing to your website or blog.

See advertisement on page 46 of this issue.

Universe Software GmbH

Deutzer Str. 35
Neuss, 41468
Sales: 49-4231-928887
Main web site: www.pdf-office.com

We make extremely powerful and award-winning PDF software solutions. 100 % Adobe® PDF compatible and less expensive. In addition to that we provide our users with unique services: Our update, upgrade and support services guarantee a maximum protection of your investments. And we offer free trial versions of all programs.

See advertisement on page 40 of this issue.

Utilities4Less.com

1652 Cross Bridge Place
Thousand Oaks, CA 91362
Sales: (800) 906-8686
Main web site: www.utilities4less.com

Utilities4Less offers its clients a full range of communications services. Utilities4Less is committed to offering the best products available at the lowest possible prices.

See advertisement on page 56 of this issue.

Worldwide Media Inc. - MostWantedDomains

Post Office Box 129
Highlands, NC 28741
Main web site:
www.mostwanteddomains.com

Domain name marketing, acquisition, and optimization.

See advertisement on page 24 of this issue.

ZAGG Inc

3855 So. 500 W., Suite J
Salt Lake City, UT 84115
Sales: 888-940-ZONE (9663)
Main web site: www.shieldzone.com

ZAGG Inc is an industry leading manufacturer and provider of consumer products and services focusing on electronic handheld accessories. Our flagship product, the invisibleSHIELD, is a revolutionary film that has replaced the need for bulky cases and cheap screen protectors.

See advertisement on page 16 of this issue.

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The MacTech DVD - Volumes 1.01-24.12 is packed with more than ever before -- almost 3100 articles from more than 280 issues **(1984 - 2008)** written by over 850 experts, all 29 issues of Apple's develop, 21 issues of FrameWorks magazine, 100+ MB of source code, MacTech Viewer, working applications, full documentation, demos for techs, ***and more!*** The latest version includes all kinds of third party applications, videos, and demos.

Everything is displayed in the very fast, very searchable ***MacTech Viewer!*** An application that has been designed specifically with Techs in mind. Search quickly through almost 25 years of of great information provided by MacTech. Information to save you time, and make your life easier.

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Requires Mac OS X v. 10.4.5 or later

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THE MACTECH SPOTLIGHT

Björn Winckler

http://b4winckler.wordpress.com/

What's the name of your company?
KTH (Stockholm, Sweden)

What do you do?
Currently studying for a PhD in Mathematics

How long have you been doing what you do?
I've been at university for the past eight years and before that I worked as a games programmer for about four years.

What was your first computer?
Commodore 64

Are you Mac-only, or a multi-platform person?
Mac-only and enjoying it!

What attracts you to working on the Mac?
The simplicity — I like the fact that everything is so well integrated and that I don't have to waste time reinstalling and configuring programs.

What's the coolest thing about the Mac?
The hardware I'd say: I have a MacBook Air and it really is an incredible computer.

What's the coolest tech thing you've done using OS X?
MacVim of course!

Ever?
A few years back one of my (NTFS) drives crashed and the file system got corrupted. I tried desperately to find some drive recovery software but either they were too expensive or just did not do what I needed. In the end I wrote my own app to scan the drive and ended up salvaging almost all the lost files. That was pretty exciting!

Where can we see a sample of your work?
Visit the MacVim home page:

http://code.google.com/p/macvim/

and download the latest snapshot build to try out MacVim. There you can find links to the source code repository as well.

The next way I'm going to impact IT/OS X/the Mac universe is:
I like working on projects that I myself have some real use for and since programming is more of a hobby for me it has to be fun as well. Who knows what the future may hold...

What else should we know?
MacVim would not be where it is today if it wasn't for the generosity of its users: a while back my old iBook G4 started acting up on me and I could no longer do any development. I put up a note on the MacVim website asking for donations and not long thereafter I had received enough money for a shiny new MacBook Air.

Vim itself was created by Bram Moolenaar and if it wasn't for the hard work that he and all Vim contributors put in, MacVim would not exist at all. If you enjoy using MacVim I encourage you to show your support by donating to Vim's charity (see www.vim.org).

My blog is a repository for random notes that I want to remember and that may be of interest for others as well. It's not updated often, but you can take a look at it.

MT

If you or someone you know belongs in the MacTech Spotlight, let us know! Send details to editorial@mactech.com

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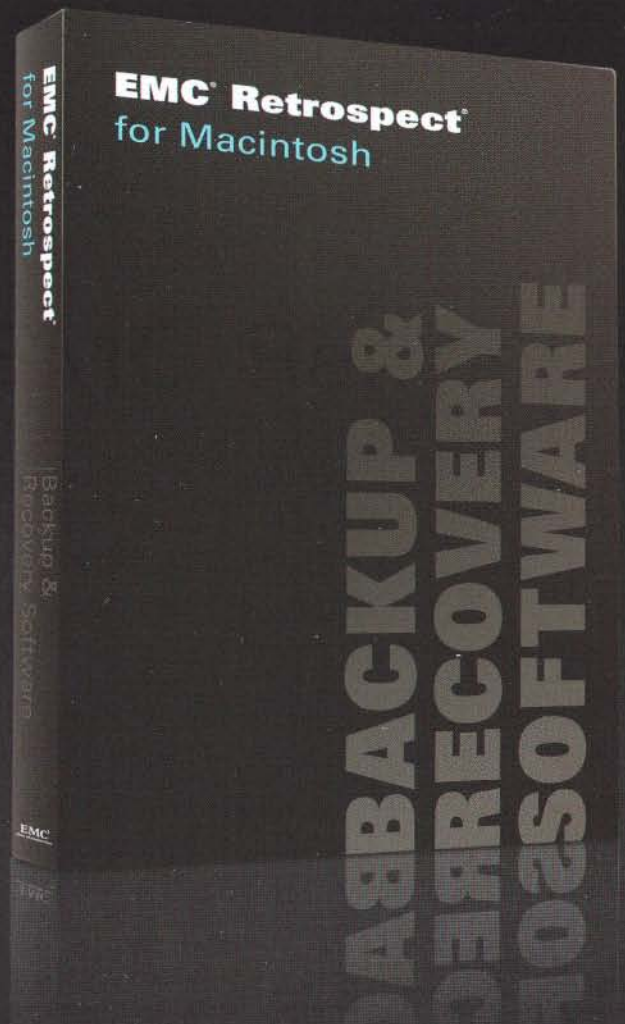

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